

Trouble-shooting instructions : ALF-5004  
BOSCH system : L-Jetronic  
Make of vehicle : ALFA-ROMEIO  
Basic microcard : FIA 01/J22

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## SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following vehicle models with 1.962/4-cyl. engine:

Alfa Romeo Spider EU 03.87->  
USA 06.83->

- \* L-Jetronic with 35-pin control unit:  
0 280 000 221  
Actuated from term.1 of ignition coil
- \* 5-pin air-flow sensor
- \* 7-pin control relay
- \* Pressure sensor for altitude compensation
- \* Start valve and thermo-time switch
- \* Lambda sensor for lambda closed-loop control and catalytic converter
- \* CO sampling point upstream of the catalytic converter. If necessary, use Alpha Romeo adapter C 20051.
- \* For measuring the fuel pressure, use pressure gauge and hose lines of the pressure tester.
- \* Connect 3-way line KDJE-P 100/13 between fuel inlet line.

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

**ATTENTION:** Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

**CAUTION!**  
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

\* Avoid injection of fuel when testing the compression.  
To ensure this, disconnect main relay.

For further precautionary measures, see basic instructions.

## TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (Ignition, fuel injection).
6. Maximum engine power/ top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

| Cause (component fault) |   |   |   |   |   |   |   |   |   | Coord.                               |
|-------------------------|---|---|---|---|---|---|---|---|---|--------------------------------------|
| *                       | * | * | * | * | * | * | * | * | * | Universal test adapter               |
| *                       |   |   |   |   |   |   |   |   |   | Electric fuel pump                   |
| *                       | * | * | * |   |   |   |   |   |   | Auxiliary-air device                 |
| *                       | * | * | * | * | * | * | * |   |   | Air-flow sensor                      |
| *                       | * | * |   |   |   | * |   |   |   | Cold-start valve                     |
| *                       |   | * |   |   |   |   |   |   |   | Thermo-time switch                   |
| *                       | * | * | * |   | * |   |   |   |   | Suction plant                        |
|                         |   | * | * | * |   | * | * |   |   | Solenoid-injection valves            |
| *                       | * | * |   |   | * | * |   |   |   | Fuel pressure                        |
|                         |   |   |   | * | * |   |   |   |   | Fuel quantity                        |
|                         |   | * | * | * | * |   |   |   |   | Throttle valve                       |
|                         |   |   |   | * |   |   |   |   |   | Ground                               |
| *                       | * | * | * | * | * |   |   |   |   | Alternator, interference suppression |
|                         |   | * | * | * | * |   |   |   |   | CO exhaust-gas adjustment            |
|                         |   |   |   | * |   |   |   |   |   | Control unit defective               |

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01  
Adapter lead: 1 684 463 129

| Test step | Switch<br>V | $\Omega$ | Terminals         | Testing of<br>component/function                                     | Test instructions/<br>Test conditions   | Set values                         |
|-----------|-------------|----------|-------------------|--|---|------------------------------------|
| 1         | 3           | -        | 4 - 5<br>(+) (-)  | Voltage of ignition and<br>starting switch term.50                   | Neutral position of transmission, start | 8...15 V                           |
| 2         | 4           | -        | 34 - 5<br>(+) (-) | Voltage of control<br>relay term.87b via the<br>auxiliary-air device | Neutral position of transmission, start | 8...15 V                           |
| 3         | 5           | -        | 1 - 5<br>(+) (-)  | Term.1 signal from<br>ignition coil term.1                           | Neutral position of transmission, start | Ignition pulses<br>on oscilloscope |
| 4         | 6           | -        | 10 - 5<br>(+) (-) | Voltage of control<br>relay term.87b                                 | Switch on ignition                      | 8...15 V                           |
| 5         | 7           | -        | 15 - 5<br>(+) (-) | Voltage of 1st<br>injection valve                                    | Switch on ignition                      | 8...15 V                           |
| 6         | 8           | -        | 33 - 5<br>(+) (-) | Voltage of 2nd<br>injection valve                                    | Switch on ignition                      | 8...15 V                           |
| 7         | 9           | -        | 32 - 5<br>(+) (-) | Voltage of 3rd<br>injection valve                                    | Switch on ignition                      | 8...15 V                           |
| 8         | 10          | -        | 14 - 5<br>(+) (-) | Voltage of 4th<br>injection valve                                    | Switch on ignition                      | 8...15 V                           |
| 9         | 12          | -        | 29 - 5<br>(+) (-) | Voltage of main relay<br>term.87                                     | Switch on ignition                      | 8...15 V                           |

# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (Continued)

Adapter lead : 1 684 463 129

| Test step | switch | Ω  | Termin-<br>als | Testing of<br>components/function                             | Test instructions/<br>Test conditions   | Set values                    |
|-----------|--------|----|----------------|---|---|-------------------------------|
| 10        | <br>V  | 6  | 7 - 5          | Resistance of<br>potentiometer in<br>air-flow sensor          | Deflect air-flow sensor flap as far as it will go   | 80...600 Ω                    |
| 11        | <br>V  | 7  | 8 - 5          | Resistor combination<br>in air-flow sensor                    |   | 260...520 Ω                   |
| 12        | <br>V  | 8  | 9 - 5          | Resistance value<br>of total resistance in<br>air-flow sensor | Disconnect 3-pin cable connector from pressure sensor<br>(altitude sensor).   | 400...800 Ω                   |
| 13        | <br>V  | 9  | 2 - 18         | Resistance of idle<br>contact                                 | Connect cable connector of pressure sensor.<br>Disconnect EI control-unit plug.<br>Accelerator pedal in idle position:<br>Slightly depress accelerator pedal: | 0...10 Ω<br>infinity Ω        |
| 14        | <br>V  | 10 | 3 - 18         | Resistance of full-<br>load contact                           | Connect EI control-unit plug.<br>Accelerator pedal in idle position:<br>Fully depress accelerator pedal:  | infinity Ω<br>0...10 Ω        |
| 15        | <br>V  | 11 | 27 - 5         | Temperature sensor<br>(intake air)                            | +15...30 °C :<br>approx. +80 °C :   | 1.45...3.3 k Ω<br>280...360 Ω |
| 16        | <br>V  | 12 | 13 - 5         | Temperature sensor<br>(engine)                                | +15...30 °C :<br>approx. +80 °C :   | 1.3...3.6 k Ω<br>250...390 Ω  |
| 17        | <br>V  | 13 | 16 - 5         | Ground,<br>output stage                                       |   | 0...10 Ω                      |



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (Continued)  
Adapter lead: 1 684 463 129

| Test step | Switch |          | Termin-<br>als | Testing of<br>component/function        | Test instructions/<br>Test conditions  | Set values                                   |
|-----------|--------|----------|----------------|---|--|--|
|           | V      | $\Omega$ |                |   |  |  |
| 18        | I<br>V | 14       | 17 - 5         | Ground,<br>output stage                 |  | 0...10 $\Omega$                              |
| 19        | I<br>V | 8        | 9 - 5          | Resistance of pressure<br>sensor        | Disconnect 5-pin cable connector from air-flow sensor.   | 2.3...2.8 k $\Omega$                         |
| 20        | I<br>V | 19       | 12 - 5         | Resistance of pressure<br>sensor, wiper | at 977 mbar (approx. 300 m altitude):<br>at 616 mbar (approx. 4,000 m altitude):<br>After the measurement, re-connect 5-pin cable<br>connector of air-flow sensor. | 2.0...2.5 k $\Omega$<br>2.2...2.7 k $\Omega$ |

TEST SPECIFICATIONS

|  |                                    |
|--|------------------------------------|
| Pressure regulator   |                                    |
| * Fuel pressure:   | 2,3...2,7 bar                      |
| Electric fuel pump   |                                    |
| * Fuel delivery in return:   | at least 650 cm <sup>3</sup> /30 s |
| * Supply voltage under load:   | at least 12 V                      |
| In-tank pre-supply pump  |                                    |
| * Fuel delivery:   | at least 750 cm <sup>3</sup> /30s  |
| Temperature sensor (intake air).   |                                    |
| At air-flow sensor at term.6 and term.27                                 |                                    |
| * Internal electrical resistance at ambient temperature (+15°C...+30°C): | 1,45...3,3 k Ω                     |
| with engine at norm. op. temp. (approx. +80°C):                          | 280...360 Ω                        |
| Temperature sensor (engine)  |                                    |
| * Internal electrical resistance at ambient temperature (+15°C...+30°C): | 1,3...3,6 k Ω                      |
| with engine at norm. op. temp. (approx. +80°C):                          | 250...390 Ω                        |
| Auxiliary-air device   |                                    |
| * Internal electrical resistance:  | 20...55 Ω                          |
| Air-flow sensor  |                                    |
| * Resistance value between term.6 and term.9:                            | 400... 800 Ω                       |
| term.6 and term.8:   | 260... 520 Ω                       |
| term.6 and term.7:   |                                    |
| (fully deflect air-flow sensor flap)                                     | 80... 600 Ω                        |
| term.7 and term.8:   | 200...1000 Ω                       |
| term.8 and term.9:   | 140... 280 Ω                       |

TEST SPECIFICATIONS (CONTINUED)

|   |                              |                              |                           |
|---|------------------------------|------------------------------|---------------------------|
| Solenoid-operated injection valve   |                              |                              |                           |
| * Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C):    |                              |                              | 2...3 Ω                   |
| Pressure sensor (altitude sensor)   |                              |                              |                           |
| * 300 m altitude (977mbar):   |                              |                              | 2,0...4,0 V               |
| 4,000m altitude (616mbar):  |                              |                              | 8,0...12,0 V              |
| Resistance between term.2 (-) and term.3 (+):                                   |                              |                              | 2,3...2,8 k Ω             |
| Thermo-time switch 35°/8s   |                              |                              |                           |
| * Internal electrical resis. at   | Between term. "G" and ground | Between term. "W" and ground | Between term. "G" and "W" |
| Ambient temperature below +30°C   | 25...40 Ω                    | 0 Ω                          | 25...40 Ω                 |
| Eng. at norm. op. temp. above +40°C   | 25...80 Ω                    | 100...160 Ω                  | 50...80 Ω                 |
| Cold-start valve  |                              |                              |                           |
| * Internal electrical resistance:   |                              |                              | 3,5...4,5 Ω               |
| * Leaks: maximum permissible:   |                              |                              | 1 drops/min.              |
| Lambda-sensor heater  |                              |                              |                           |
| * Internal electrical resistance:   |                              |                              | 1...15 Ω                  |
| Idle adjustment   |                              |                              |                           |
| * Manually shifted transmission:  |                              |                              | 900...1000 min -1         |
| * CO content:   |                              |                              | 0,5...0,7 % by vol.       |
| Measuring point: upstream of the catalytic conv.                                |                              |                              |                           |
| To do this, pull apart lambda-sensor plug and disconnect tank-ventilation hose. |                              |                              |                           |
| If necessary, use Alfa Romeo adapter C 20051.                                   |                              |                              |                           |

## TEST SPECIFICATIONS (CONTINUED)

Lambda closed-loop control

Measure CO content upstream of catalytic converter and run engine (at normal operating temperature) at idle.

Disconnect tank-ventilation hose.

### \* Rich value

Pull apart lambda-sensor plug and apply control-unit side to ground.

CO content:

increases to above  
0,7 % by vol.

Perform this measurement only briefly so as not to overload catalytic converter.

### \* Lean value

Apply 2 V to control-unit side of sensor lead.

CO content:

drops to below 0,5 % by vol.  
Engine running rough

### \* Control value

Re-connect sensor lead.

Connect tank-ventilation hose.

CO content:

0,3...1,0 % by vol.

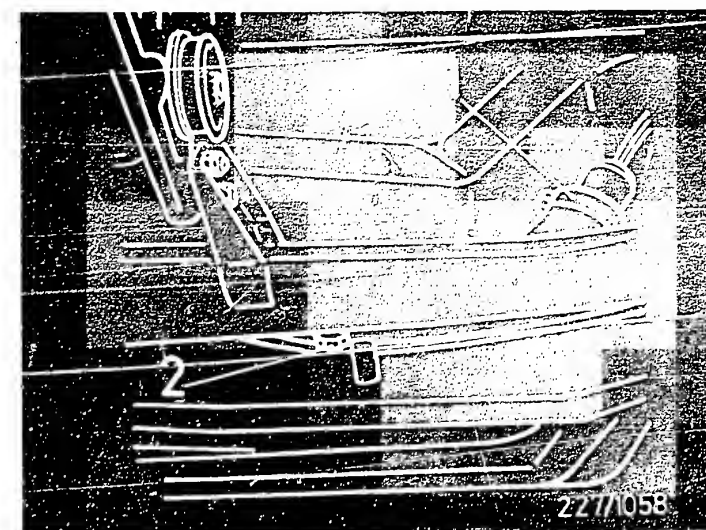
Disconnect intake-manifold-pressure actuation (air hose) from pressure regulator.

CO content:

briefly increases and falls back to control value given above.

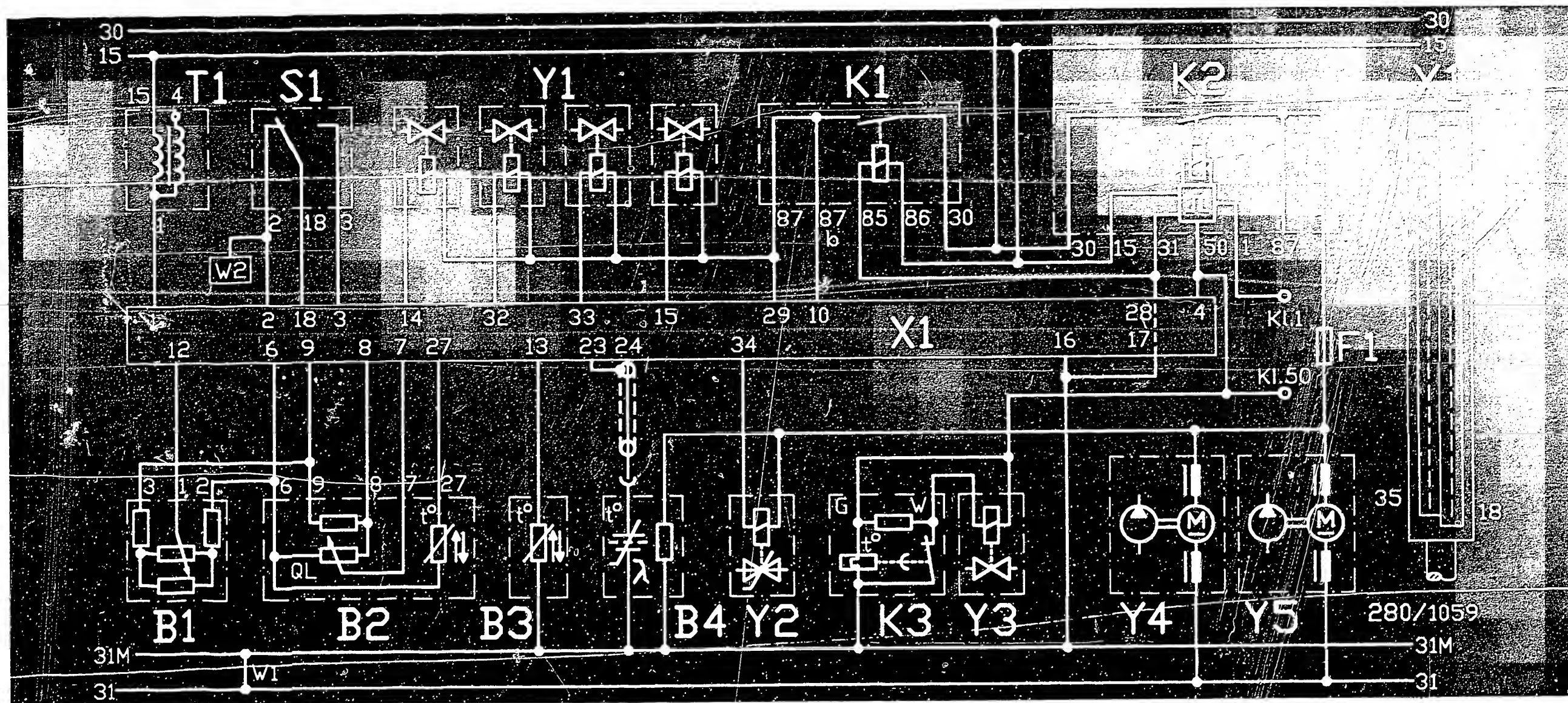
During the period while analyzing and adjusting the exhaust-gas emissions, switch off the suction plant.

See the equipment and Autodata microcards for the setting values for ignition, valve clearance and other engine-related data.



1 = Lambda sensor

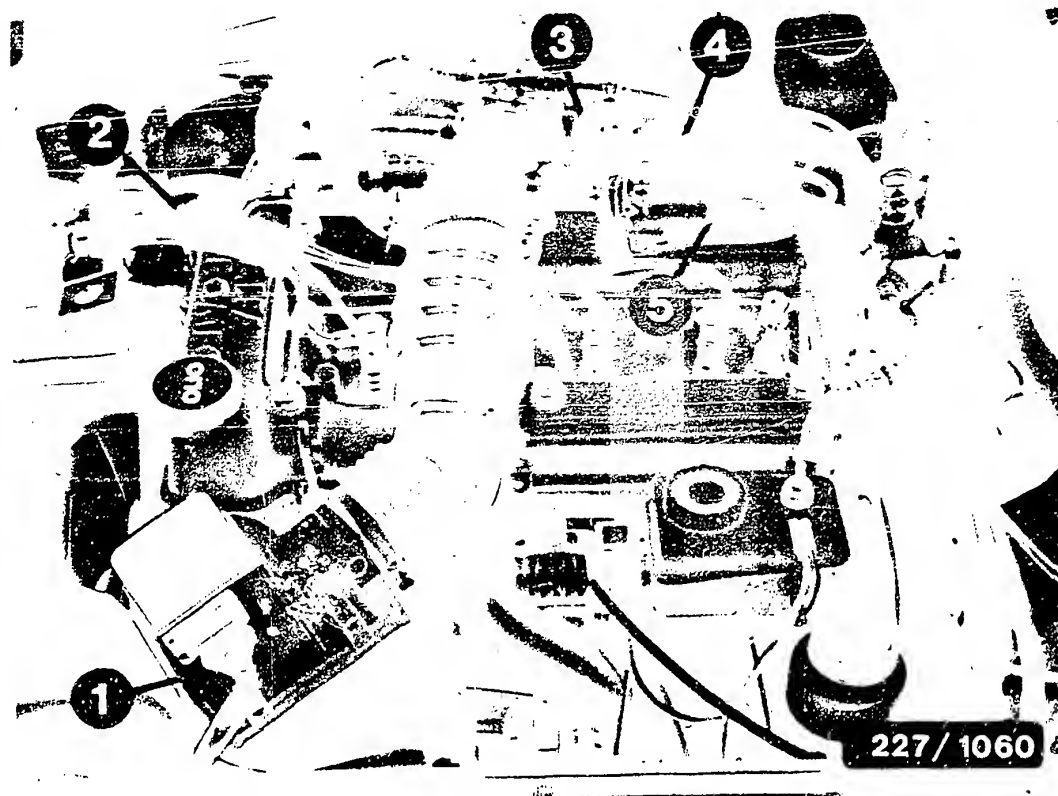
2 = Measuring point for CO content



B1 = Pressure sensor (alt. sensor)  
 B2 = Air-flow sensor  
 B3 = Temperature sensor (engine)  
 B4 = Heated lambda sensor  
 F1 = Pump fuse  
 K1 = Main relay  
 K2 = Control relay  
 K3 = Thermo-time switch  
 S1 = Throttle-valve switch  
 T1 = Ignition coil  
 W1 = Ground strap, engine  
 W2 = to EI-control unit term.2

X1 = Control-unit plug  
 Y1 = Solenoid-op. inj. vlvs.  
 Y2 = Auxiliary-air device  
 Y3 = Cold-start valve  
 Y4 = Electric fuel pump  
 Y5 = In-tank pre-supply pump

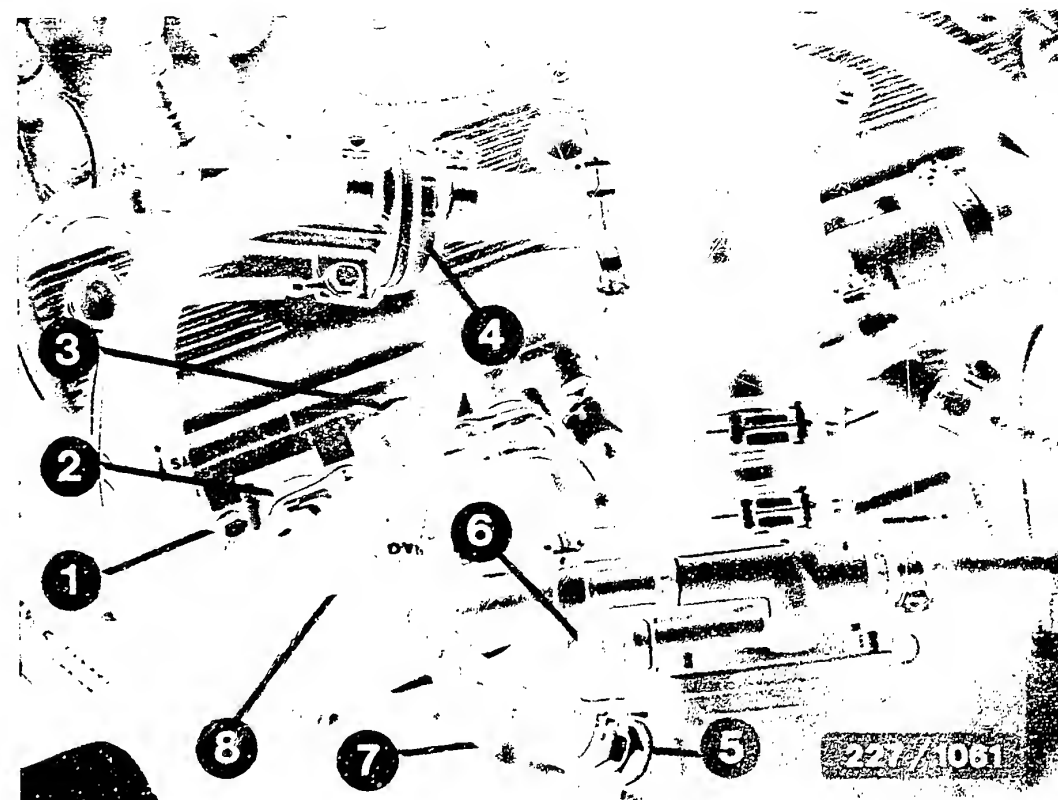
ELECTRICAL TERMINAL DIAGRAM



# INSTALLATION POSITION OF COMPONENTS

The indications "right" and "left" always refer to the forward direction of travel.

- 1 = Air-flow sensor
- 2 = To pressure regulator
- 3 = Throttle-valve switch
- 4 = Cold-start valve
- 5 = Auxiliary air device



# INSTALLATION POSITION OF COMPONENTS (Cont.)

- 1 = Central ground
- 2 = Solenoid-operated injection valve
- 3 = Temperature sensor (coolant)
- 4 = Auxiliary-air device
- 5 = Idle-speed adjusting screw
- 6 = Throttle-valve switch
- 7 = Cold-start valve
- 8 = Thermo-time switch

## INSTALLATION POSITION OF COMPONENTS (Continued)

EI control unit (upper illustration, Item 1) and vacuum sensor (upper illustration, Item 2) are located behind the right-hand side panelling.

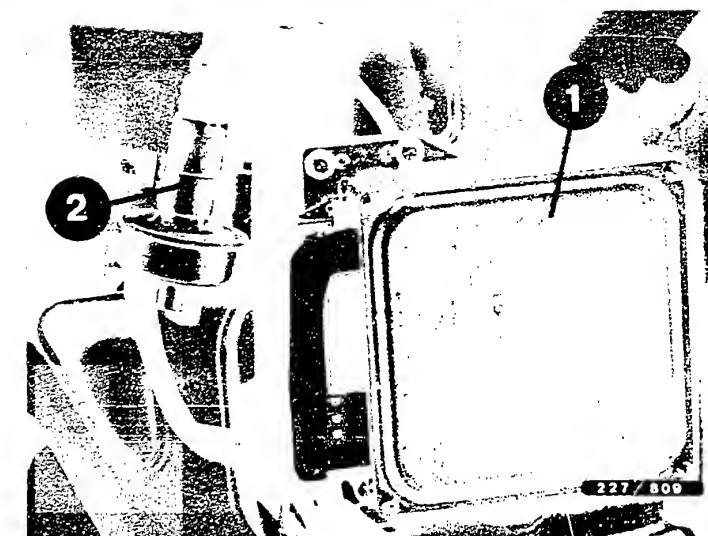
Note on removal: fold the seat backrest forwards and loosen the screws of the side panelling (lower illus., arrows).

Further installation positions:

Lambda sensor plug is located on the left-hand side on the inside of the fender.

Electric fuel pump and fuel filter are located beneath the vehicle on the right-hand side in front of the rear wheel.

In-tank pre-supply pump is located in the tank. Access is gained via the closure beneath the floor matting in the trunk.

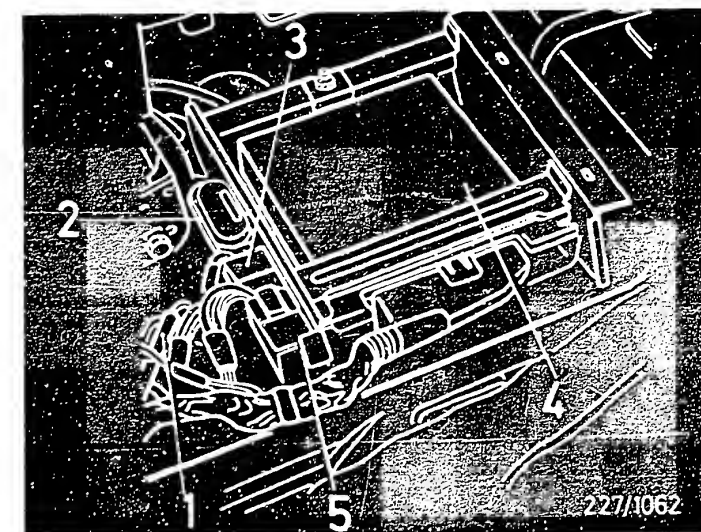




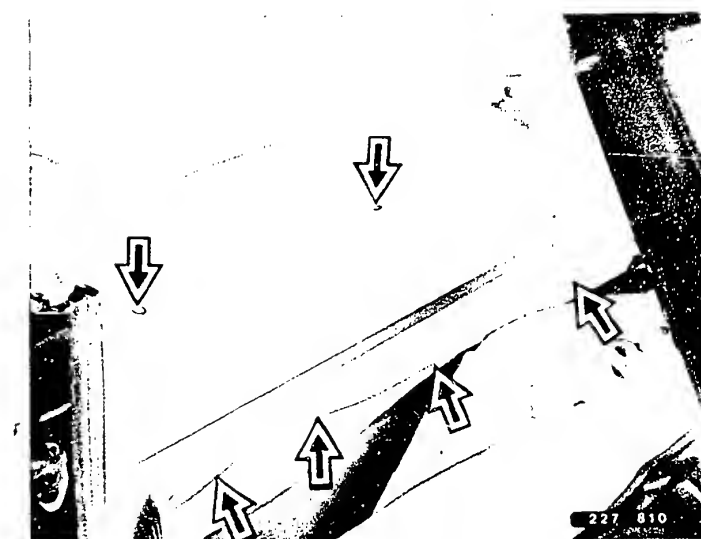
## INSTALLATION POSITION OF COMPONENTS (Continued)

L-Jetronic control unit (upper illustration) is located beneath the suitcase storage space.

Note on removal: loosen the hook and loop fastener of the suitcase storage space and unscrew the fastening screws (see lower illustration, arrows).



- 1 = Pump fuse
- 2 = Pressure sensor (altitude sens
- 3 = Control relay
- 4 = Control unit
- 5 = Main relay



Trouble-shooting instructions : AUD-5004  
BOSCH system : KE-Jetronic 3.2  
Make of vehicle : AUDI  
Basic microcard : PKW-053

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## SPECIAL FEATURES

\* These instructions contain KE-Jetronic trouble-shooting, valid at the time of publication, for the following Audi models:

AUDI 100, 100 Quattro  
Engine NF / 2.3 l / 5 cylinders 08.86->

- \* KE-Jetronic system version 3.2 with self-diagnosis and flashing-code output
- \* Final-controlling element diagnosis
- \* Tank vent with pulsed valve
- \* Lambda closed-loop control
- \* In-tank electric fuel pump
- \* EZ (EI) 127 K ignition system with self-diagnosis and flashing-code output



## SPECIAL FEATURES (CONTINUED)

### KE control unit and EI-K control unit

Both control units are electrically connected to each other. The component, altitude sensor, idle switch, full-load switch, and diagnostic lamp pass on information to both control units. When reading out the self-diagnosis, pay attention to in which indication mode the fault codes appear. After activation of the self-diagnosis, the stored faults of the EI-K control unit are output first, then followed by the stored faults of the KE control unit.

### Final-controlling-element diagnosis

The KE control unit has a final-controlling-element diagnosis facility with which the components, pressure actuator, tank-vent valve, idle actuator, and cold-start valve, can be tested electrically and mechanically with regard to proper functioning.

## SPECIAL FEATURES (CONTINUED)

### Tank-ventilation system

The fuel vapors which develop in the fuel tank are accumulated in the activated-carbon filter. When the engine is running, it inducts these fuel vapors out of the filter. A pulsed tank-vent valve, which is installed between the activated-carbon filter and inlet manifold, proportions the amount of fuel vapors fed.

Depending upon the operating condition of the engine, the KE-Jetronic control unit controls the opening cross-section in the tank-vent valve via the on/off ratio. In this way, too severe a change in mixture is avoided.

The tank-vent valve is open when it is de-energized when the ignition is switched off.

In order to prevent running on (dieseling), the tank-vent valve drops out after a delay when the ignition is switched off.

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.

For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

**ATTENTION:** Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, trigger boxes and control units or to the ignition system, be sure to observe the information in the basic instructions.

### CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For testing the compression, disconnect the pump relay in order to prevent undesired injection by the injection valves.

Important information with regard to working on the KE Jetronic.

If any fuel connections are loosened or parts removed, also on the vacuum system, always use new seals when re-connecting or re-mounting.

Be sure to keep everything clean when working on the KE-Jetronic. Clean the external areas of fuel connections thoroughly before loosening them.

While conducting tests with the electric fuel pump running, never deflect (lift) the air-flow sensor plate, since this leads to fuel being injected via the injection valve. This may lead to very serious damage to the engine, when the engine is started afterwards.

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts, but dies again.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

|Cause (component fault)

|   |   |   |   |   |   |   |   |   |   |   |                       |
|---|---|---|---|---|---|---|---|---|---|---|-----------------------|
| * | * | * | * | * | * | * | * |   |   | * | Self-diagnosis        |
| * | * | * | * | * | * | * |   | * | * |   | Pressure actuator     |
|   |   | * |   |   |   |   |   |   |   |   | Tank-vent valve       |
|   |   | * |   |   |   |   |   |   |   |   | Idle actuator         |
| * |   | * |   |   |   | * |   |   |   |   | Cold-start valve      |
| * |   | * | * |   | * |   |   |   |   |   | Intake system         |
| * | * | * | * |   |   |   | * |   |   |   | Air-flow sensor       |
| * |   |   |   |   |   |   | * |   |   |   | Air-flow sensor plate |
| * | * |   |   | * | * |   |   |   |   |   | Electric fuel pump    |
| * | * |   |   | * | * |   |   |   |   |   | Primary pressure      |
| * | * | * | * | * | * | * |   |   |   |   | Differential pressure |
| * |   |   |   |   |   |   |   |   |   |   | Fuel system leaking   |
| * | * | * | * | * | * |   | * |   |   |   | Injection valves      |
| * | * | * | * |   | * | * |   |   |   |   | Fuel distributor      |

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts, but dies again.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

## |Cause (component fault)

|   |   |   |   |   |   |   |   |                                     |
|---|---|---|---|---|---|---|---|-------------------------------------|
| * | * |   |   | * |   |   |   | Throttle valve                      |
| * | * | * | * | * |   | * | * | Voltage supply, control unit        |
| * | * | * | * | * | * |   |   | Temperature sensor (coolant)        |
|   |   | * | * |   |   |   |   | Throttle-valve switch,<br>idle      |
|   |   |   |   | * |   | * | * | Throttle-valve switch,<br>full load |
|   |   | * | * | * |   |   |   | Lambda closed-loop control          |
| * | * | * | * |   | * |   |   | Exhaust-gas adjustment              |
|   |   | * |   |   |   |   |   | Low-idle-speed control              |
| * |   |   |   |   |   |   |   | Starting enrichment                 |
|   | * |   |   |   |   |   |   | Post-starting enrichment            |
|   | * | * | * |   |   |   |   | Warm-up enrichment                  |
|   |   |   | * |   |   |   |   | Acceleration enrichment             |
|   |   |   | * | * |   |   |   | Full-load enrichment                |
|   |   |   |   | * |   |   |   | Overrun cut-off                     |

# SELF-DIAGNOSIS TEST TABLE

| Fault indication<br>Flashing code | Testing of<br>component/function                      | Test instructions/<br>Test conditions   | Termi-<br>nals   | Set values                                  | Coord. |
|-----------------------------------|---|---|------------------|---|--------|
| 1 1 1 1                           | Control units   | Pay attention to whether fault-code output applies to EI-K or KE!<br>EI-K control unit or KE control unit defective.  |                  |   |        |
| 2 1 2 1                           | Idle throttle-valve switch and/or lead defective      | Pay attention to whether fault-code output applies to EI-K or KE!<br>Idle throttle-valve switch constantly closed.<br>Lead to terminal 28 has short circuit to positive.<br>Incorrect adjustment.<br>Throttle valve closed:<br>Throttle valve open:<br>Test adjustment:   | KE 28<br>EI-K 7  | 0 $\Omega$<br>infinity $\Omega$<br>0.6 mm   |        |
| 2 1 2 2                           | No engine-speed signal from ignition system           | Break in lead from KE control unit terminal 30 to EI-K control unit terminal 17.<br>Test continuity in lead:<br>Check ignition system:  | KE 30<br>EI-K 17 | 0 $\Omega$<br>see SIS                       |        |
| 2 1 2 3                           | Full-load throttle-valve switch and/or lead defective | Pay attention to whether fault-code output applies to EI-K or KE! Full-load throttle-valve switch constantly closed.<br>Lead to terminal 28 has short circuit to positive.<br>Incorrect adjustment.<br>Throttle valve closed:<br>Throttle valve open:<br>Test adjustment: | KE 31<br>EI-K 9  | infinity $\Omega$<br>0 $\Omega$<br>68...76° |        |
| 2 1 4 1                           | Knock control at control stop                         | Check ignition system:  |                  | see SIS                                     |        |
| 2 1 4 2                           | Knock sensor and/or lead defective                    | Check ignition system:  | —                | see SIS                                     |        |

## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

| Fault indication<br>Flashing code | Testing of<br>component/function  | Test instructions/<br>Test conditions  | Termi-<br>nals            | Set values   | Coord. |
|-----------------------------------|---|--|---------------------------|--|--------|
| 2 2 2 3                           | Altitude sensor and/or<br>lead defective  | Pay attention to whether fault-code output applies to EI-K or KE! Test voltage supply of altitude sensor at terminals 2 and 3. Test voltage signal at terminals 1 and 3.<br>Open circuit in lead.<br>Test continuity in lead:  | KE 25,<br>26,35<br>EI-K 2 | 4.35...5.35 V<br><br>0 $\Omega$  |        |
| 2 2 3 2                           | Potentiometer on<br>air-flow sensor and/or<br>lead defective  | Test voltage supply of potentiometer at terminals 1 and 3. Test voltage signal at terminals 1 and 2.<br>Open circuit in lead.<br>Test continuity in lead:  | KE 23,<br>26,35           | 4.35...5.35 V<br><br>0 $\Omega$  |        |
| 2 2 3 3                           | Reference voltage for<br>load and altitude<br>signals for EI-K<br>control unit                                | Break in lead from KE control unit terminal 26 to EI-K control unit terminal 21.<br>Test continuity in lead:   | KE 26<br>EI-K 21          | <br><br>0 $\Omega$   |        |
| 2 3 1 2                           | Temperature sensor<br>(coolant) and/or<br>lead defective<br>(double NTC, one<br>terminal for KE-<br>Jetronic) | Pay attention to whether fault-code output applies to EI-K or KE! Break in lead from KE control unit terminal 3 to temperature sensor (coolant) or short circuit to ground.<br>Test continuity in lead:<br>Test short circuit in leads to ground:<br>Resistance value, temperature sensor (coolant)<br>* Engine cold (+15°C...+30°C)<br>* Engine at normal operating temperature (approx. 80° C) | KE 3                      | <br><br>0 $\Omega$<br>infinity $\Omega$<br><br>1300...3600 $\Omega$<br>250... 390 $\Omega$ |        |
| 2 3 4 2                           | Lambda sensor and/or<br>lead defective  | Break in lead from KE control unit 7 to lambda sensor, short-circuited to ground or battery voltage.<br>Test continuity in lead:<br>Test short circuit in leads to ground<br>and test battery voltage:<br>Watch out for damage to the wire insulation!<br>Sensor heater defective.   | KE 7                      | <br><br>0 $\Omega$<br><br>infinity $\Omega$  |        |

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

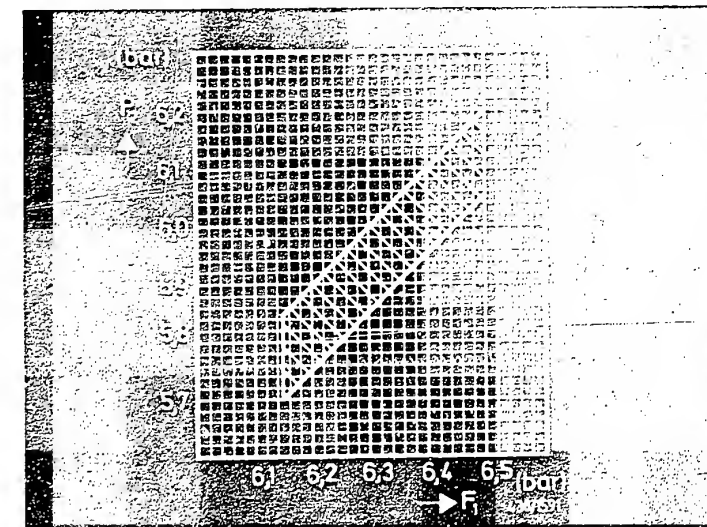
| Fault indication<br>Flashing code | Testing of<br>component/function           | Test instructions/<br>Test conditions  | Termi-<br>nals | Set values   | Coord. |
|-----------------------------------|--|--|----------------|--|--------|
| 4 3 4 1                           | Pressure actuator<br>and/or lead defective | Test resistance of pressure actuator:<br>Test continuity in lead:  | KE 4.5         | 16...22 $\Omega$<br>0 $\Omega$                         |        |
| 4 3 4 3                           | Tank-vent valve and/or<br>lead defective   | Break in lead from KE control unit terminal 15 to<br>tank-vent valve, or short circuit to ground.<br><br>Voltage supply (ignition, terminal 15) to<br>tank-valve interrupted.<br>Test continuity in lead:<br>Test short circuit in leads to ground:        | KE 15          | Battery voltage<br><br>0 $\Omega$<br>infinity $\Omega$ |        |
| 4 4 3 1                           | Idle actuator and/or<br>lead defective     | Break in lead from KE control unit terminal 17 to<br>idle actuator, or short circuit to ground.<br>Voltage supply (ignition, terminal 15) to<br>idle actuator interrupted.<br>Test continuity in lead:<br>Test short circuit in leads to ground:           | KE 17          | Battery voltage<br><br>0 $\Omega$<br>infinity $\Omega$ |        |
| 4 4 4 3                           | Cold-start valve and/or<br>lead defective  | Break in lead from KE control unit terminal 16 to<br>cold-start valve, or short circuit to ground.<br><br>Voltage supply (ignition, terminal 15) to<br>cold-start valve interrupted.<br>Test continuity in lead:<br>Test short circuit in leads to ground: | KE 16          | Battery voltage<br><br>0 $\Omega$<br>infinity $\Omega$ |        |
| 4 4 4 4                           | When no fault present                      |  |                |  |        |
| 0 0 0 0                           | End of fault output                        |  |                |  |        |

# TEST SPECIFICATIONS

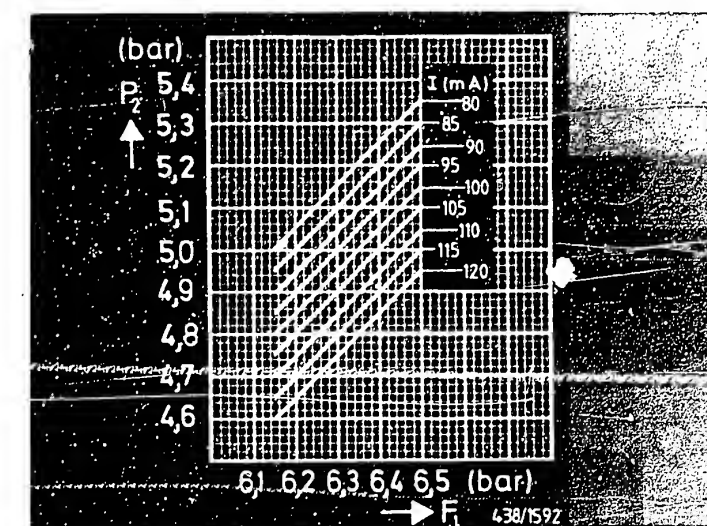
| No. | Testing/Test conditions  | Set value   |
|-----|--|---|
| 1   | Engine-speed signal from EI-K control unit to KE control unit:   | approx. 5 V   |
| 2   | Supply voltage for altitude sensor:<br><br>Voltage signal from altitude sensor:<br><div>Sea level<br/>500 m<br/>1000 m<br/>1500 m<br/>2000 m<br/>3000 m</div>                  | 4,35...5,35 V<br><br><br>3,2...4,7 V<br>2,8...4,0 V<br>2,4...3,5 V<br>2,0...3,0 V<br>1,5...2,5 V<br>0,8...1,6 V |
| 3   | Supply voltage for potentiometer on air-flow sensor:<br><br>Voltage signal from potentiometer:<br>air-flow sensor plate in neutral position<br>air-flow sensor plate deflected | 4,35...5,35 V<br><br>0 V<br>max. 5,35 V   |
| 4   | Resistance value, temperature sensor (coolant):<br>engine cold (+15°C...+30°C)<br>Engine at normal operating temperature (approx. 80°C)  | 1300...3600 Ω<br>250...390 Ω  |
| 5   | Lambda closed-loop control:<br>open-loop control operation<br><br>closed-loop control operation<br><br>rich stop<br>lean stop  | -1...+1 mA<br>(static)<br>-1...+1 mA<br>(pulsating)<br>max. +10 mA<br>max. -10 mA                               |
| 6   | Resistance value, pressure actuator:   | 16...22 Ω   |
| 7   | Resistance value, tank-vent valve:   | 35...55 Ω   |
| 8   | Resistance value, idle actuator:   | 4...12 Ω  |
| 9   | Resistance value, cold-start valve:  | 6...14 Ω  |

# TEST SPECIFICATIONS (CONTINUED)

| No. | Testing/Test condition  | Set value                                     |  |
|-----|---|---|--|
| 10  | Air-flow sensor plate position (neutral position) below basic setting:  | 1,9...3,0 mm                                  |  |
| 11  | Air-flow sensor plate idle travel:  | 0,1...0,2 mm                                  |  |
| 12  | Electric fuel pump - fuel delivery:<br>Supply voltage (under load):   | min. 1160 cm <sup>3</sup> /min<br>min. 11,5 V |  |
| 13  | Fuel distributor - primary pressure:  | 6,15...6,5 bar                                |  |
| 14  | Differential pressure<br><br>Take lower-chamber pressure "warm" set value corresponding to primary pressure measured from upper chart. (Actuator current = 0 mA)<br><br>Take lower-chamber pressure "cold" set value corresponding to primary pressure measured and actuator current from lower chart.<br>Simulation of "cold" condition: switch on ignition (peak coil current approx. 10 mA). |   |  |
| 15  | Leakage test - total system:<br><br>Minimum pressure after 10 min.:<br>Minimum pressure after 20 min.:  | 3,3 bar<br>3,2 bar                            |  |
| 16  | Injection valves - opening pressure:  | 3,7...4,8 bar                                 |  |
| 17  | Fuel deliveries - comparative measurement:<br>Actuator current: 0 A<br><br>Idle:<br>Part load:<br>Full load:<br><br>Minimum delivery at max. air-flow sensor plate deflection:  | Setting point:<br>(cm <sup>3</sup> /min)      | Max. allowable delivery:<br>(cm <sup>3</sup> /min) |
|     |   | 6,0<br>40,0<br>100,0                          | 6,6<br>42,5<br>109,0                               |
|     |   | 125,0 cm <sup>3</sup> /min                    |  |



p 1 = Primary pressure  
p 2 = Lower-chamber pressure  
I = Actuator





## TEST SPECIFICATIONS (CONTINUED)

| No. | Testing/Test conditions        | Set value                         |
|-----|--------------------------------|-----------------------------------|
| 18  | Rate of flow, KE restriction   | cm <sup>3</sup> /min              |
| 19  | Control-unit functions:        |                                   |
|     | Starting enrichment            | 130...150 mA                      |
|     | Post-start enrichment          | 105...110 mA                      |
|     | Warm-up enrichment             | 25...30 mA                        |
|     | Acceleration enrichment        |                                   |
|     | * Slowly increase engine speed | Current value increases           |
|     | Full-load enrichment           | 4...8 mA                          |
|     | Overrun cut-off                | -40...-60 mA                      |
| 20  | CO-content adjustment*         |                                   |
|     | Idle speed:                    | 670...770 min <sup>-1</sup>       |
|     | CO content:                    |                                   |
|     | * Lambda sensor disconnected   |                                   |
|     | Check value                    | 0,3...3,0 % by vol.               |
|     | Setting                        | 0,6...1,0 % by vol.               |
|     | * Lambda-sensor connected      |                                   |
|     | Pressure-actuator current      | 0,3...2,2 % by vol.<br>-1...+1 mA |

## \* Notes on CO-content adjustment:

Adjustment of the idle speed is not possible.

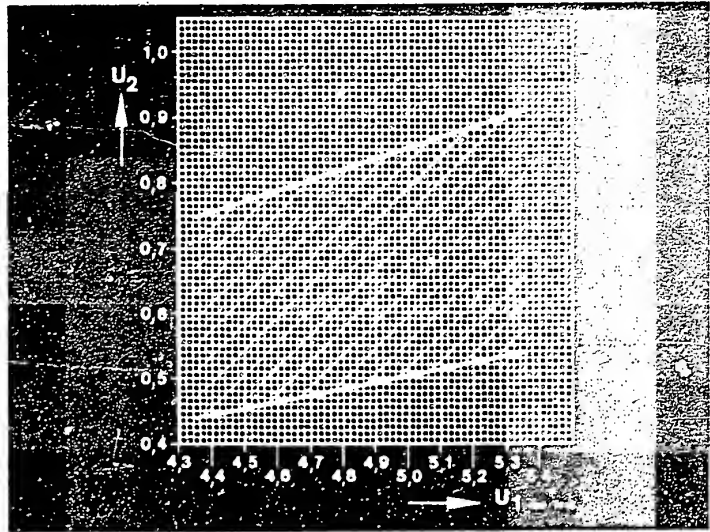
Engine-oil temperature at least 80 °C.

Hose for crankcase ventilation is disconnected and sealed off tightly.

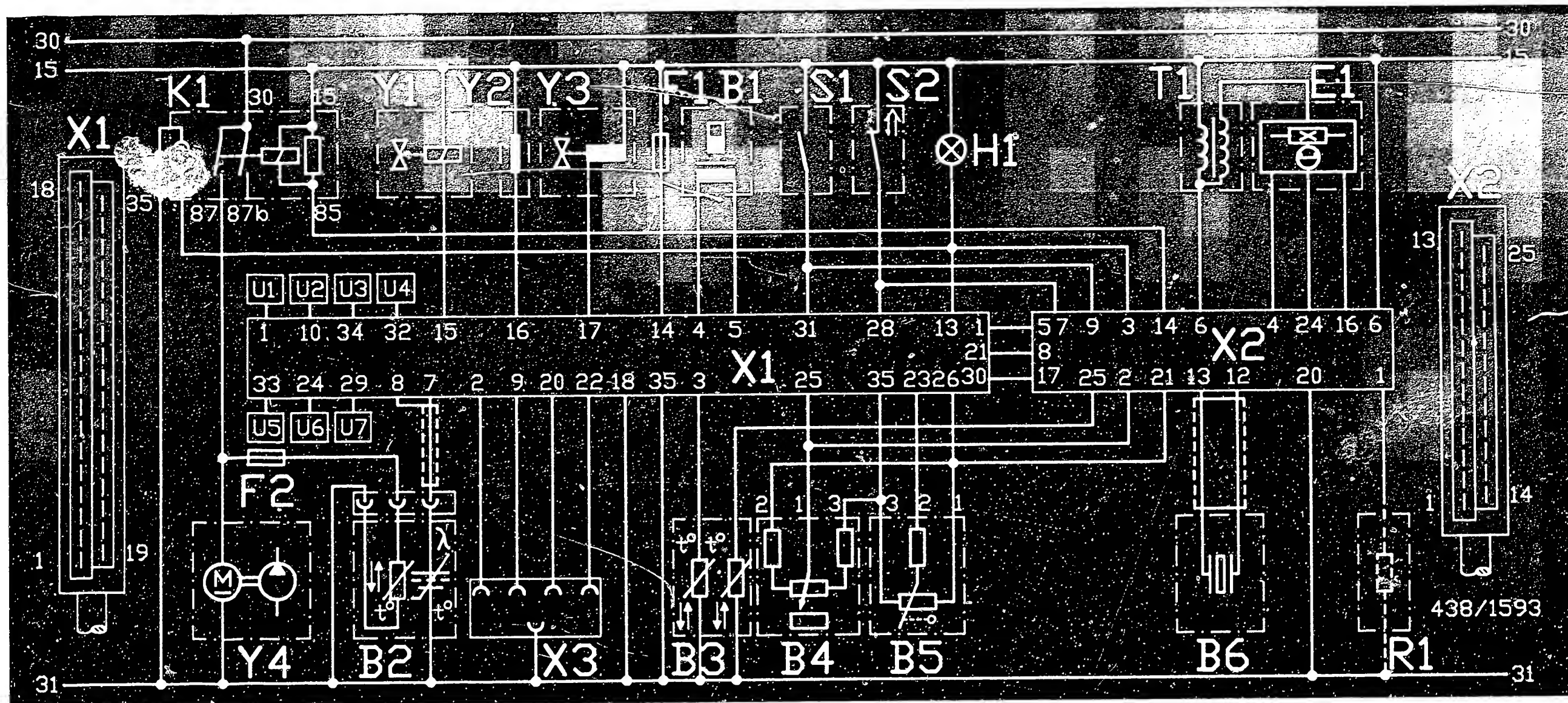
Disconnect the hose line to the activated-carbon filter on the air scoop (bracket remains open in the scoop).

TEST SPECIFICATIONS (CONTINUED)

| No. | Testing/Test conditions  | Set value                                      |
|-----|--|--|
| 21  | Signal, air-flow sensor potentiometer<br>(measurement necessary only when idling and part-load behavior are poor).<br><br>* Measure supply voltage at potentiometer terminals 1(+) and 3(-) and not down:<br><br>* Measure voltage signal of potentiometer terminals 2(+) and 3(-) with engine at normal operating temperature and at idle speed and compare with set value from chart opposite. | <br><br><br>4,35...5,35 V<br><br><br>see chart |



U 1 = Supply voltage,  
potentiometer  
U 2 = Potentiometer  
voltage signal

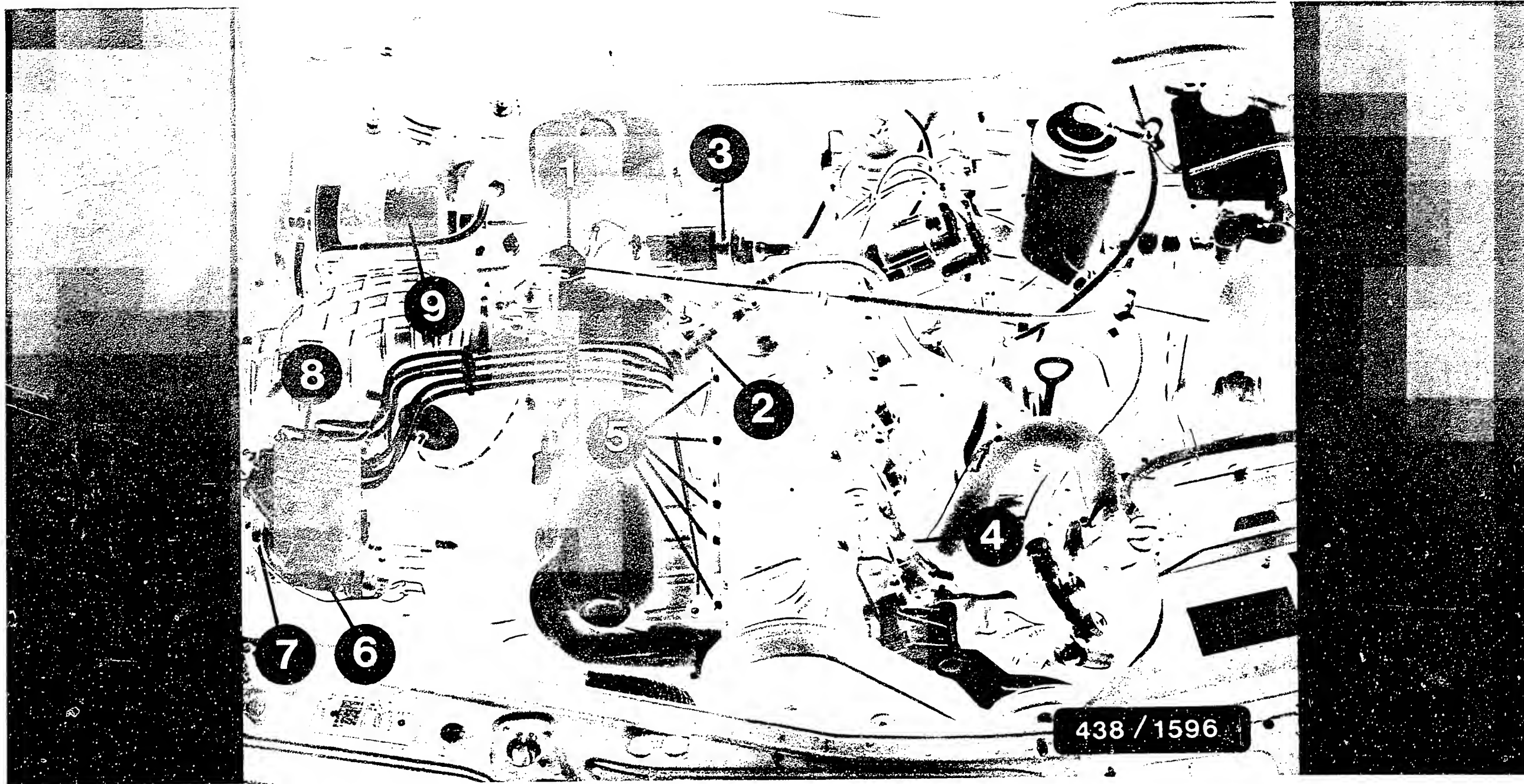


B1 = Pressure actuator  
 B2 = Lambda sensor  
 B3 = Temperature sensor (coolant)  
 B4 = Altitude sensor  
 B5 = Air-flow sensor potentiometer  
 B6 = Knock sensor  
 E1 = Ignition distributor  
 F1 = 10 A fuse  
 F2 = 8 A fuse  
 H1 = Diagnostic lamp

K1 = Electric-fuel-pump relay  
 R1 = Resistance, variant encoding  
 S1 = Full-load throttle-valve switch  
 S2 = Idle throttle-valve switch  
 T1 = Ignition coil  
 U1 = Connection, diagnosis interface  
 U2 = Connection, on-board computer  
 U3 = Connection, transmission switch  
 (in vehicles with man. shifted trans. to ground)  
 U4 = Connection, air-conditioner readiness for op.

U5 = Connection, air-cond. compress.  
 U6 = Connection, idle encoding  
 U7 = Connec., overrun cut-off supp.  
 X1 = Plug, KE control unit  
 X2 = Plug, EI-K control unit  
 X3 = Plug, parameter encoding  
 Y1 = Tank-vent valve  
 Y2 = Cold-start valve  
 Y3 = Idle actuator  
 Y4 = Electric fuel pump

ELECTRICAL TERMINAL DIAGRAM



- 1 = Full-load throttle-valve switch.  
The idle throttle-valve switch  
(not visible in illustration) is located  
on the underside of the throttle-valve assembly.
- 2 = Cold-start valve
- 3 = Idle actuator

- 4 = Temperature sensor (coolant)
- 5 = Injection valves
- 6 = Pressure actuator
- 7 = Potentiometer on air-flow sensor
- 8 = Fuel distributor
- 9 = Fuel filter

#### INSTALLATION POSITION OF COMPONENTS

## INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The EI-K control unit is located in the footwell on the driver's side.

The altitude sensor is located above the EI-K control unit.

Access can be gained to the components after removing the tray, the release lever for the engine-compartment hood, and the side covering.

The KE control unit is located in the footwell on the passenger's side. Access may be gained to the control unit after the tray and side covering are removed.

The fuel accumulator is located at the vehicle floor panel between the rear axle and fuel tank.

The pressure regulator is located next to the mixture-control unit in the right-hand wheel house.

The activated-carbon filter with the tank-vent valve is installed next to the mixture-control unit in the right-hand wheel house.

Access may be gained to the in-tank electric fuel pump from the luggage compartment. To remove the pump, take away the luggage-compartment mat and unscrew the round closing cover (3 screws).

For production reasons:  
continued on the following  
coordinate.

# TABLE OF CONTENTS

Trouble-shooting instructions : FER-5000  
 BOSCH system : Air conditioner  
 Make of vehicle : FERRARI  
 Basic microcard : PKW-008

| Test instructions                   | Coordinates |
|-------------------------------------|-------------|
| Special features, safety, usage     | 02          |
| Trouble-shooting chart              | 04          |
| Rapid diagnosis chart               | 05          |
| Test specifications                 | 07          |
| Electrical terminal diagram         | 09          |
| Installation position of components | 13          |

## Special features

This microcard contains the trouble-shooting instructions for the electronic air conditioner in FERRARI vehicles

model Testarossa as of 82  
 model Mondial as of 82 to 86

Differences from basic instructions:  
 System without heating-water pump, outside temperature sensor and DEF switch.  
 Different plug assignment.  
 The system is tested with single instrument leads KDZS 0005.



STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults. Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Finding individual test steps in the brief and basic instructions is made easier through the use of identical test-step numbers.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

\* C A U T I O N !  
High-performance ignition system.  
Dangerous primary and secondary voltages.  
  
Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For further precautionary measures, see basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

|                         |  |
|-------------------------|--|
| 1.                      | No or poor heating effect                                    |
| 2.                      | No or poor cooling effect                                    |
| 3.                      | Blower cannot be regulated                                   |
| 4.                      | Blower not running   |
| 5.                      | 1st and/or 2nd speed(s) of auxiliary fan is/are not switched |
| Cause (component fault) |  |
| *                       | * * * * * Rapid diagnosis chart                              |
| *                       | Coolant level too low  |
| *                       | * Heating-water valve mechanically defective                 |
| *                       | * Test refrigerant level                                     |
| *                       | * Drier defective  |
| *                       | * Pressure switch defective                                  |
| *                       | * Condenser dirty  |
| *                       | * Auxiliary fan defective                                    |
| *                       | * Blower motor defective                                     |
| *                       | * Test sensor blower   |
| *                       | * Control unit defective                                     |

# RAPID DIAGNOSIS CHART FOR ELECTRONIC AIR CONDITIONER

Use commercially available multimeter in conjunction with instrument leads KDZS 0005.

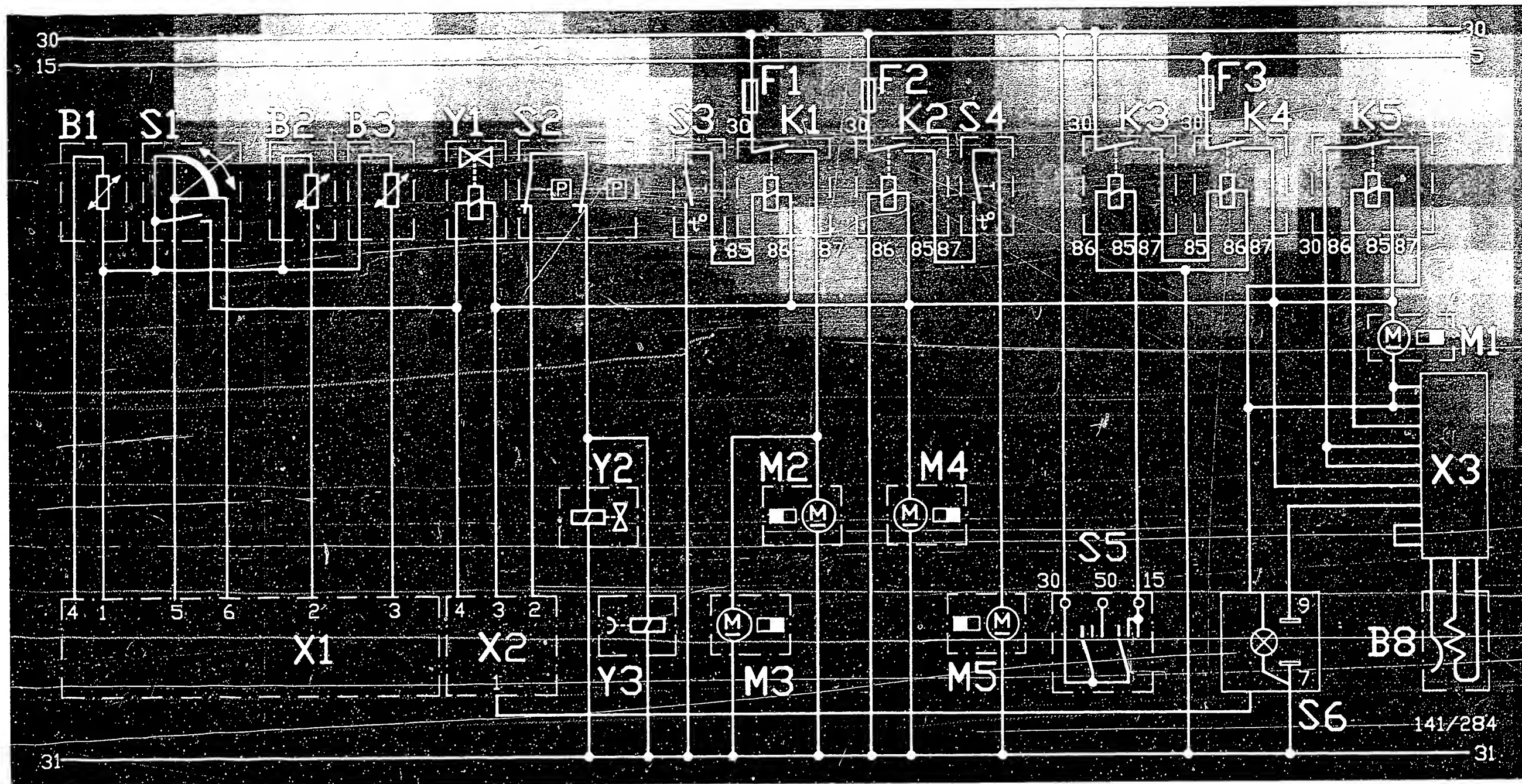
| Test step | Under test                                | Test instructions   | Terminals                            |   |
|-----------|---|---|--------------------------------------|---|
| 1         | Supply voltage, electronic control unit   | Connect voltmeter with instrument leads to control-unit plugs X2, socket 3 (+) and X1, socket 1 (-). Switch on ignition.                            | 3 (+) 1 (-)                          | Greater than 10 V   |
| 2         | Temperature thumbwheel                    | Switch off ignition. Connect ohmmeter to control-unit plug X1, sockets 6 and 1.   | 6 1                                  | Approx. 9,5...10,5 k $\Omega$   |
|           |   | Connect ohmmeter to control-unit plug X1, sockets 5 and 1. Slowly turn temperature selector from cold to warm. Resistance value must change evenly. | 5 5 1 1                              | Min: approx. 0 $\Omega$<br>Max: approx. 10 k $\Omega$                                 |
| 3         | Magnetic coupling, refrigerant compressor | Connect ammeter to control-unit plug X2, socket 3 (+) and socket 2 (-). Switch on ignition.   | 3 (+) 2 (-)                          | Approx. 1,4...2,0 A   |
| 4         | Evaporator temperature sensor             | Switch off ignition. Connect ohmmeter to control-unit plug X1, sockets 3 and 1.   | At approx. 25°C:<br>At approx. 0°C:  | 3 1 3 1<br>2,6...3,0 k $\Omega$<br>8,7...9,3 k $\Omega$                               |
| 5         | Heating-water valve                       | Connect ammeter to control-unit plugs X2, socket 4 (+) and X1, socket 1 (-). Turn temperature selector to max. heating position.                    | 4 (+) 1 (-)                          | Approx. 0,6...1,2 A   |
| 6         | Discharge-air temperature sensor          | Connect ohmmeter to control-unit plug X1, sockets 2 and 1.  | At approx. 15°C:<br>At approx. 30°C: | 2 1 2 1<br>15,8...16,4 k $\Omega$<br>7,8...8,4 k $\Omega$                             |
| 7         | Passenger-compartment temperature sensor  | Connect ohmmeter to control-unit plug X1, socket 4 and socket 1. Cool down passenger-compartment temperature sensor with refrigerant spray.         | At approx. 15°C:<br>At approx. 30°C: | 4 1 4 1 4 1<br>15,8...16,4 k $\Omega$<br>7,8...8,4 k $\Omega$<br>Resistance increases |



# TEST SPECIFICATIONS

|   | Internal resistance                    |
|---|--|
| Passenger-compartment<br>temperature sensor | 16,4...7,8 k $\Omega$<br>at 15...30 °C |
| Discharge-air<br>temperature sensor         | 16,4...7,8 k $\Omega$<br>at 15...30 °C |
| Evaporator<br>temperature sensor            | 9,3...2,6 k $\Omega$<br>at 0...25 °C   |
| Heating-water valve                         | approx. 10...20 $\Omega$               |
| Temperature selector,<br>total resistance   | approx. 9,5...10,5 k $\Omega$          |

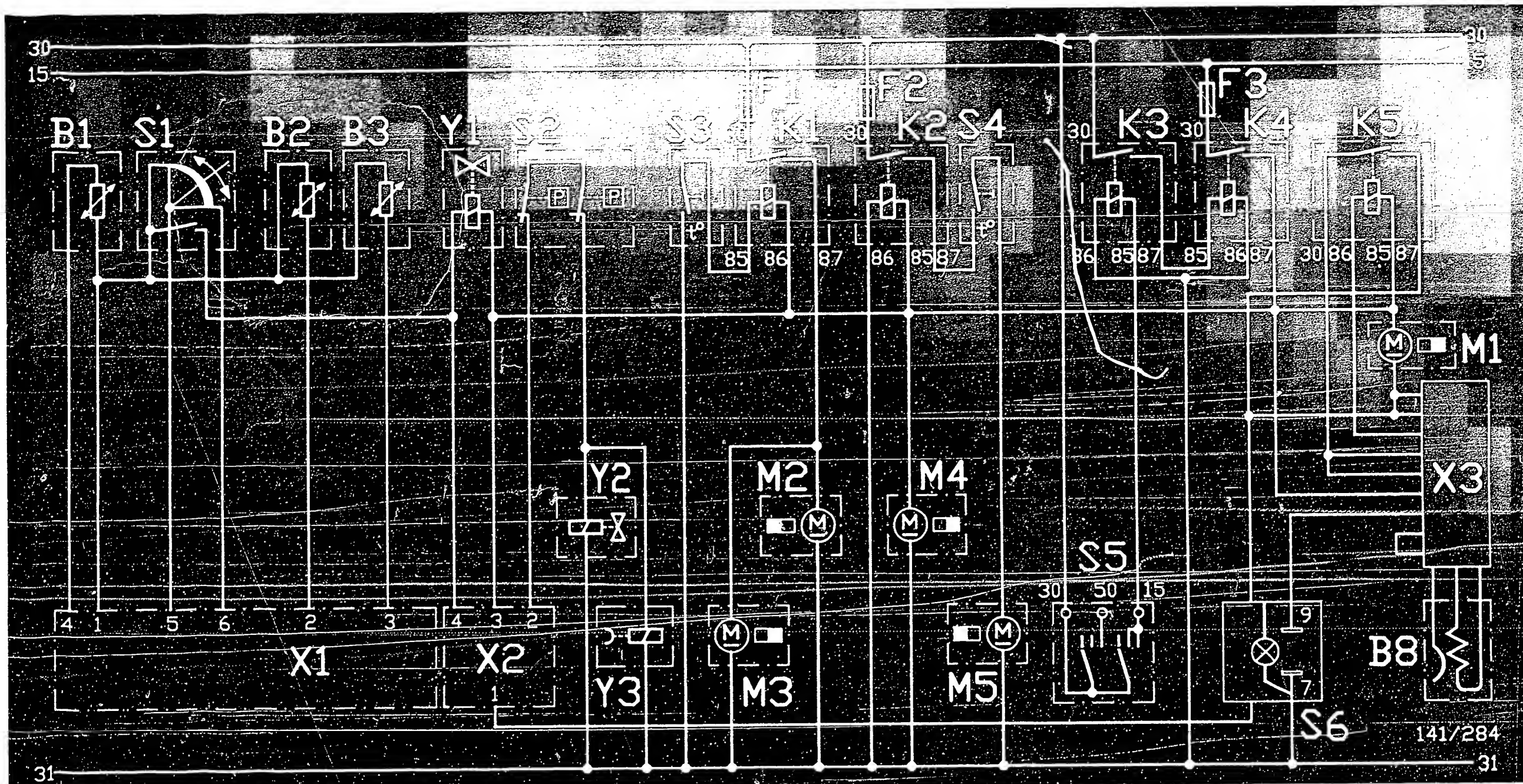
For production reasons:  
continued on the following  
coordinate.



B1 = Passenger-compartment temp. sensor  
 B2 = Discharge-air temperature sensor  
 B3 = Evaporator temperature sensor  
 B8 = Speed selector for blower  
 F1, F2, F3 = Central electrics  
 K1 = Relay for fans I and II  
 K2 = Condenser-fan relay  
 K3 = Main relay  
 K4 = Relay, terminal 15  
 K5 = Relay for power output stage of blower  
 M1 = Blower motor  
 M2 = Coolant fan II  
 M3 = Coolant fan I

M4 = Passenger-compartment temp.-sensor blower  
 M5 = Condenser fan  
 S1 = Temperature selector  
 S2 = Pressure switch, refrigerant-compressor clutch

ELECTRICAL TERMINAL DIAGRAM OF AIR CONDITIONER



S3 = Temperature switch for  
 coolant fan  
 S4 = Temperature switch for  
 condenser fan  
 S5 = Ignition lock  
 S6 = Push-button set

X1 = Control-unit plug, air conditioner, 6-pin  
 X2 = Control-unit plug, 4-pin  
 X3 = Power output stage  
 Y1 = Heating-water valve  
 Y2 = Bypass valve  
 Y3 = Compressor clutch

ELECTRICAL TERMINAL DIAGRAM OF AIR CONDITIONER (CONTINUED)

C11 ————— <==>

C12 ————— <==>

## INSTALLATION POSITION OF COMPONENTS

The installation positions of components are similar to those described in the basic instructions.

For production reasons:  
continued on the following  
coordinate.

Trouble-shooting instructions : VWV-5004  
BOSCH system : K - Jetronic  
Make of vehicle : VWV  
Basic microcard : VWV-504

## TABLE OF CONTENTS

| <u>Section</u>                           | <u>Coordinate</u> |
|--|-------------------|
| Special features.....                    | 02                |
| Structure, usage.....                    | 03                |
| Safety and precautionary measures.....   | 03                |
| Trouble-shooting chart.....              | 04                |
| Test specifications.....                 | 05                |
| Electrical terminal diagram.....         | 09                |
| Jumping safety circuit.....              | 10                |
| Diagram of air/fuel lines.....           | 11                |
| Installation position of components..... | 13                |

## SPECIAL FEATURES

\* These trouble-shooting instructions for the K-Jetronic, valid at the time of publication, apply to the following VW models:

VW Golf/Jetta Injection 08.84 to 07.87  
Engine MZ 1.781 l / 4-cyl.  
Canadian model

- \* Fuel distributor with adjustable differential-pressure valves.
- \* Updraft air-flow sensor.
- \* Injection valves with fixed air-guide cap. Air-shrouding for better mixture formation, especially at idle.  
Air distribution in cylinder head.  
  
Use adapter KDJE-P 200/19 to connect injection valves for the fuel-delivery reference measurement.
- \* In-tank electric fuel pump with screwed on pressure damper for sound-level reduction.
- \* Fuel accumulator with 40 cm<sup>3</sup> volume.



## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.

For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

**ATTENTION:** Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

### CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

### I m p o r t a n t :

Never lift the air-flow sensor plate while the electric fuel pump is running because this will inject fuel via the injection valves.

Afterwards, operation of the starter can lead to serious engine damage.

## TROUBLE-SHOOTING CHART

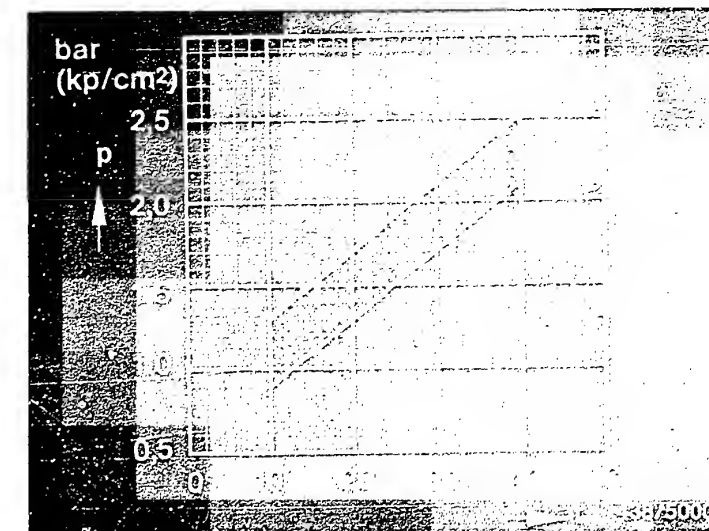
Customer complaint (fault symptoms)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engining pinging/knocking.
10. Engine becomes too hot.
11. Fault lamp.

|   |   |   |   |   |   |   |   |  |  |  | Cause (component fault)  |
|---|---|---|---|---|---|---|---|--|--|--|--------------------------|
| * | * |   |   | * |   |   |   |  |  |  | Electric fuel pump       |
| * |   | * | * | * |   |   |   |  |  |  | Air-intake system        |
| * |   |   |   |   |   |   |   |  |  |  | Fuel system              |
| * |   | * | * | * | * | * |   |  |  |  | Fuel distributor         |
| * |   | * | * | * | * | * |   |  |  |  | Air-flow sensor          |
| * |   | * |   |   |   | * | * |  |  |  | Cold-start system        |
| * |   | * |   | * |   | * |   |  |  |  | Injection valves         |
|   | * |   |   | * | * |   |   |  |  |  | Primary pressure         |
| * | * | * | * | * | * | * |   |  |  |  | Control pressure         |
| * |   | * | * | * | * |   |   |  |  |  | Fuel-delivery dispersion |
|   |   |   |   | * |   |   |   |  |  |  | Throttle valve           |
| * |   | * |   |   |   |   |   |  |  |  | Auxiliary air device     |
| * |   | * | * |   |   | * | * |  |  |  | Basic idle setting       |

# TEST SPECIFICATIONS

| No. | Test/Test conditions   | Set value  |
|-----|--|--|
| 1   | Electric fuel pump, fuel delivery:<br>Supply voltage (with load):  | at least 750 cm <sup>3</sup> /30s<br>at least 11,5 V |
| 2   | Control-pressure circuit, fuel delivery:   | 160...240 cm <sup>3</sup> /min.                      |
| 3   | Fuel distributor<br>0 438 100 133,<br>Test specification:<br>Setting:                      primary pressure:   | 4,7...5,4 bar<br>4,9...5,1 bar                       |
| 4   | Warm-up regulator ,                      control pressure:<br>0 438 140 011<br>Take "cold" control pressure corresponding to<br>ambient temperature from the accompanying chart.<br>"Warm" control pressure: | see chart<br>3,4...3,8 bar                           |
| 5   | Leakage test, total system:<br><br>Minimum pressure after 10 min.:<br>Minimum pressure after 20 min.:  | 2,5 bar<br>2,4 bar                                   |
| 6   | Injection valve, opening pressure:<br><br>Leakage test not below 2,8 bar:<br>No drop may fall within 25s.  | 3,0...4,1 bar  |



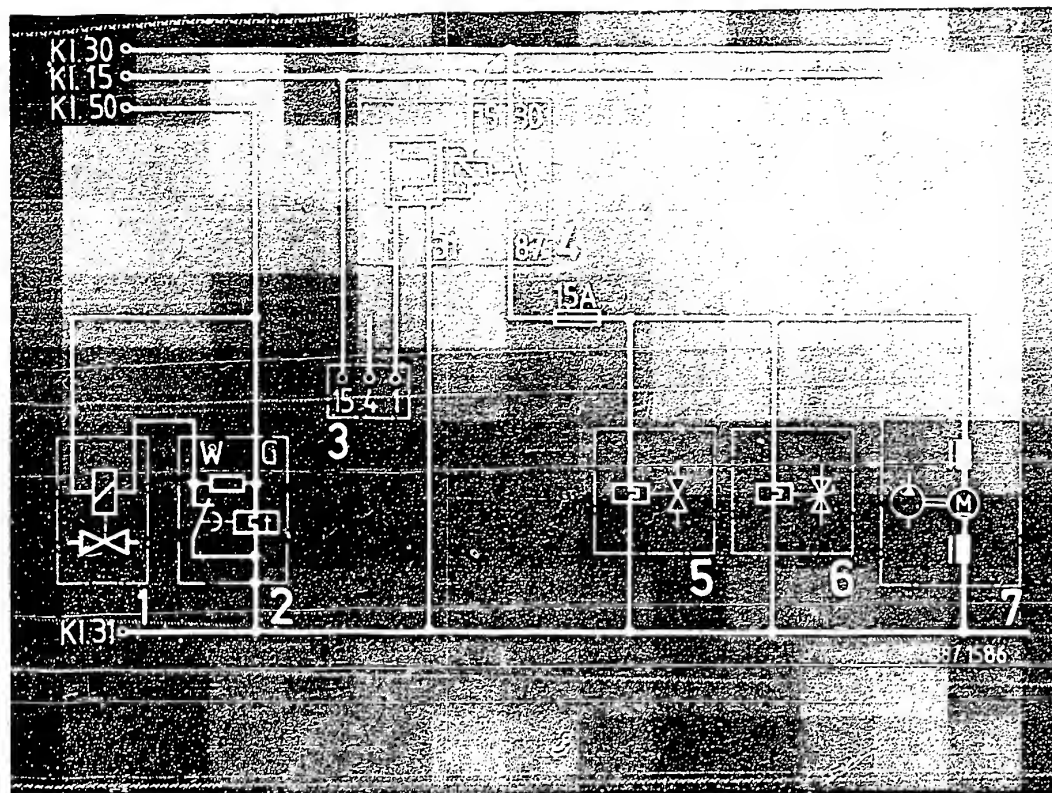
p = Control pressure  
t = Ambient temperature

## TEST SPECIFICATIONS (CONTINUED)

| No. | Test instructions/Test conditions  | Set value                                    |  |
|-----|--|--|--|
| 7   | Fuel distributor 0 438 100 133<br>Fuel delivery, reference measurement:        | Setting<br>point:<br>(cm <sup>3</sup> /min.) | Max. allow-<br>able deliv.:<br>(cm <sup>3</sup> /min.) |
|     |  |  |  |
|     |  |  |  |
|     | Idle:<br>Part load:<br>Full load:  | 6,0<br>40,0<br>122,0                         | 6,6<br>43,0<br>134,0                                   |
|     | Minimum delivery at max. air-flow sensor plate deflection:                     | 122 cm <sup>3</sup> /min.                    |  |
| 8   | Thermo-time switch 0 280 130 214/.. 223<br>Resistance test:                    | below + 30°C                                 | above + 40°C   |
|     |  |  |  |
|     |  |  |  |
|     | Terminal G and ground:<br>Terminal W and ground:<br>Terminal G and terminal W: | 25...40 Ω<br>0 Ω<br>25...40 Ω                | 50...80 Ω<br>100...160 Ω<br>50...80 Ω                  |
| 9   | Idle-speed adjustment*   |  |  |
|     |  | 800...1000 min. -1                           |  |
|     |  | 0,3...0,7 % by vol.                          |  |

\* Instructions for idle-speed adjustment:  
 Engine oil temperature of at least 80 °C.  
 Remove tube for crankcase ventilation and place so that only  
 fresh air can be inducted.  
 Switch off all electrical loads.  
 Radiator fan must not be running.

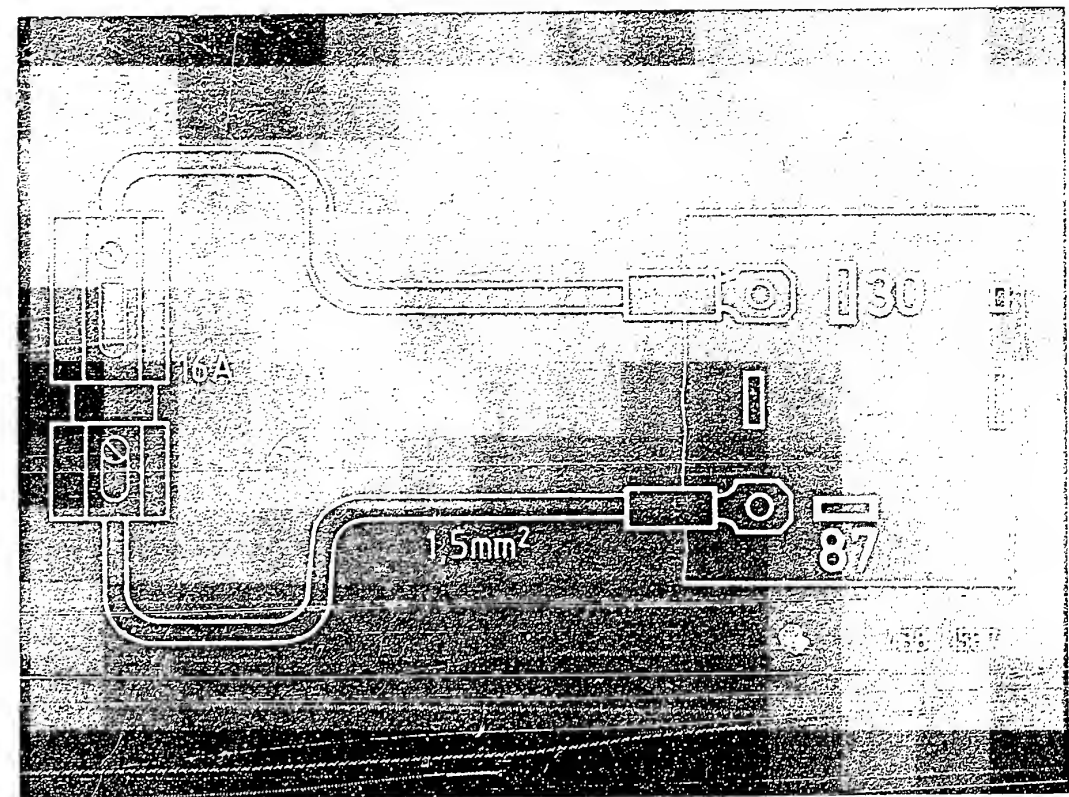




- 1 = Start valve
- 2 = Thermo-time switch
- 3 = Ignition coil
- 4 = Electronic relay
- 5 = Warm-up regulator
- 6 = Auxiliary-air device
- 7 = Electric fuel pump

#### ELECTRICAL TERMINAL DIAGRAM WITH SAFETY CIRCUIT OF ELECTRIC FUEL PUMP

The safety circuit operates with an electronic relay that is energized by terminal 1 of the ignition coil.



#### BRIDGING THE SAFETY CIRCUIT

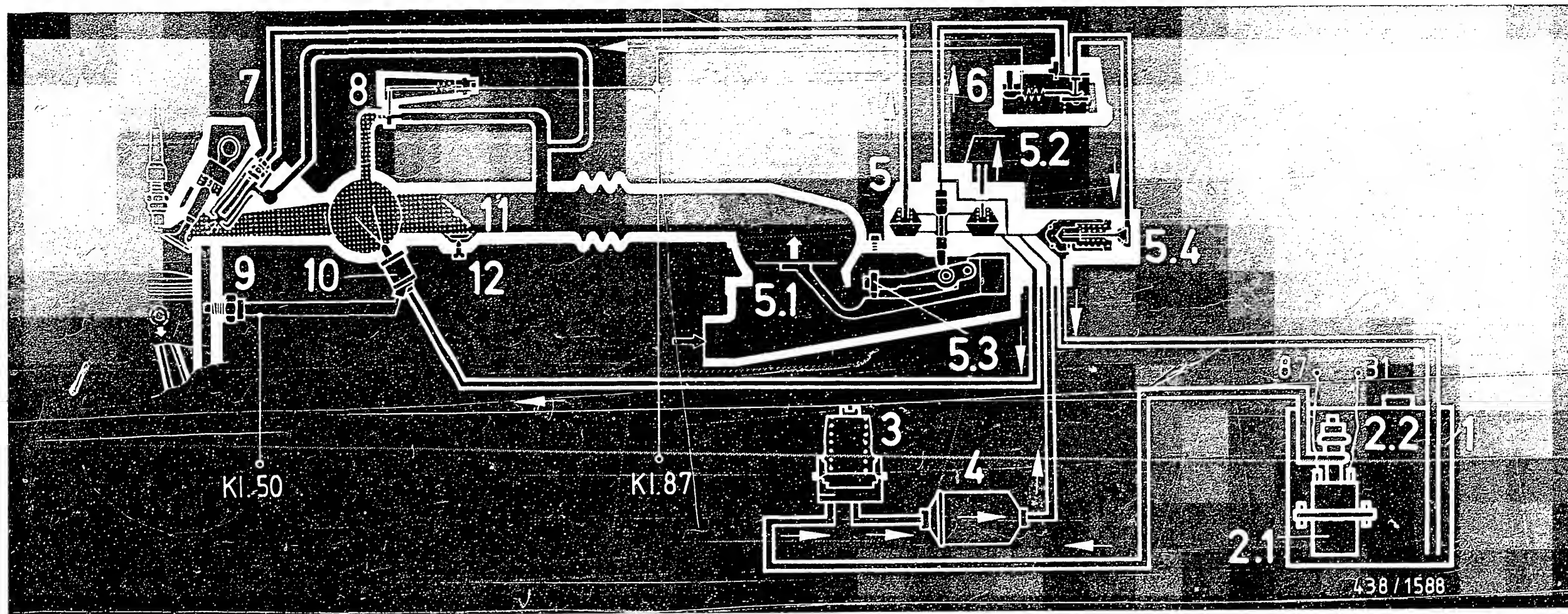
Remove electronic relay from plug-in base. Connect contact 87 to contact 30 in the plug-in base with a bridge. Use a 1.5 mm<sup>2</sup> connecting cable with fuse link and 16 amp fuse.

In this way, battery voltage is supplied to the electric fuel pump, auxiliary-air device and warm-up regulator.

#### C a u t i o n :

Never deflect (raise) the sensor plate with the electric fuel pump running, since fuel is then injected via the injection valves.

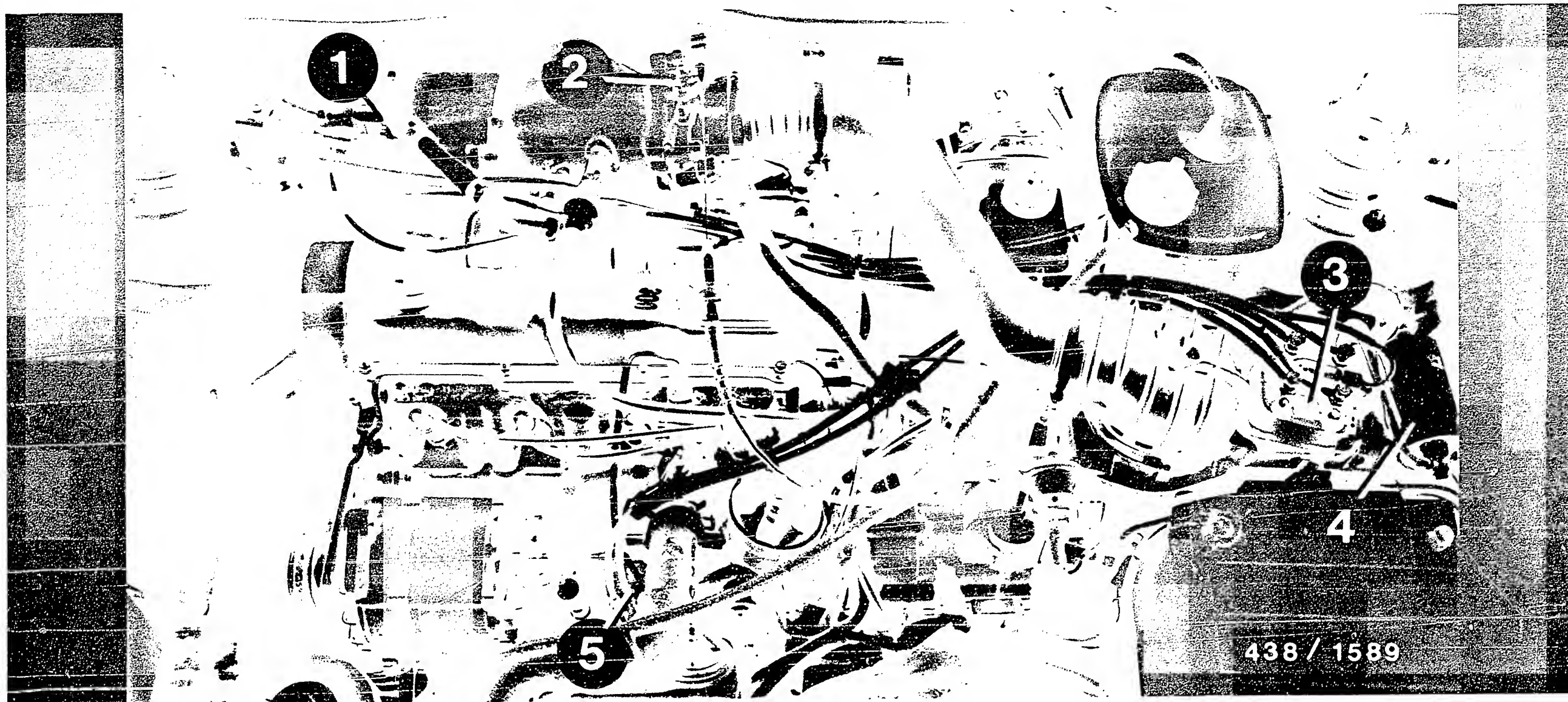
Subsequent operation of the starting motor can lead to major damage to the engine.



- 1 = Fuel tank
- 2.1 = In-tank electric fuel pump
- 2.2 = Pressure damper
- 3 = Fuel accumulator
- 4 = Fuel filter
- 5 = Mixture-control unit
- 5.1 = Air-flow sensor
- 5.2 = Fuel distributor
- 5.3 = Idle-mixture-adjusting screw

- 5.4 = Primary-pressure regulator
- 6 = Warm-up regulator
- 7 = Injection valve
- 8 = Auxiliary-air device
- 9 = Thermo-time switch
- 10 = Start valve
- 11 = Throttle valve
- 12 = Idle-speed bypass screw

DIAGRAM OF AIR/FUEL LINES



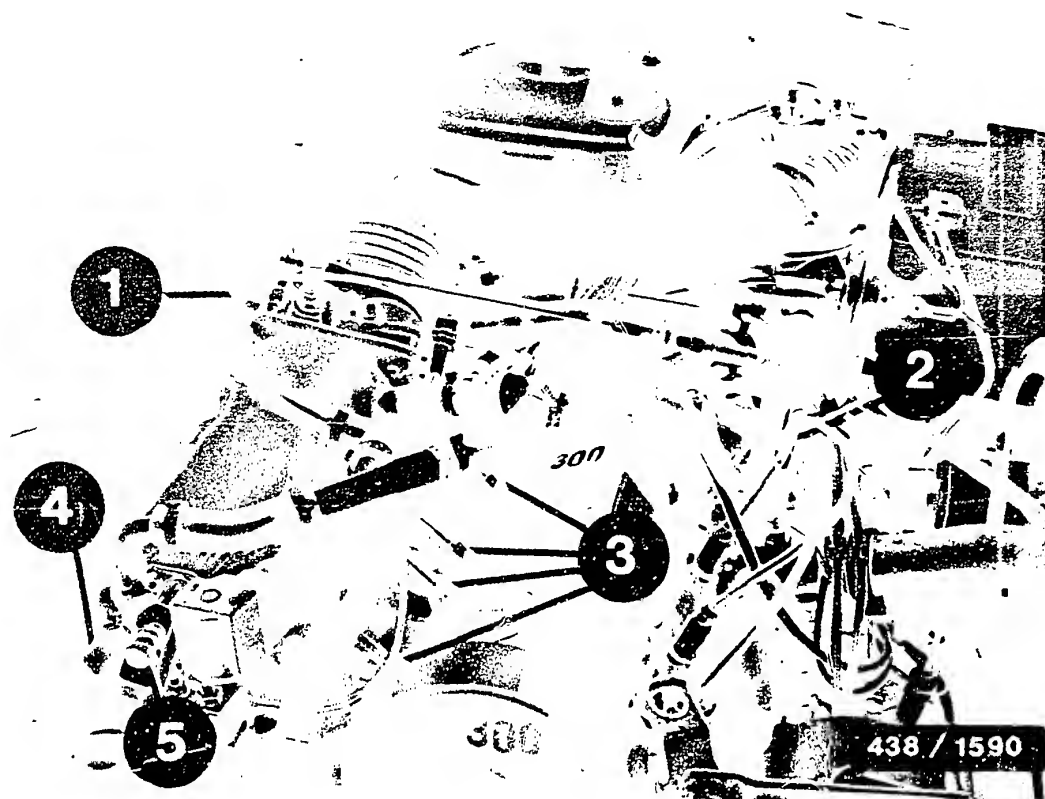
# INSTALLATION POSITION OF COMPONENTS

Location of components in engine

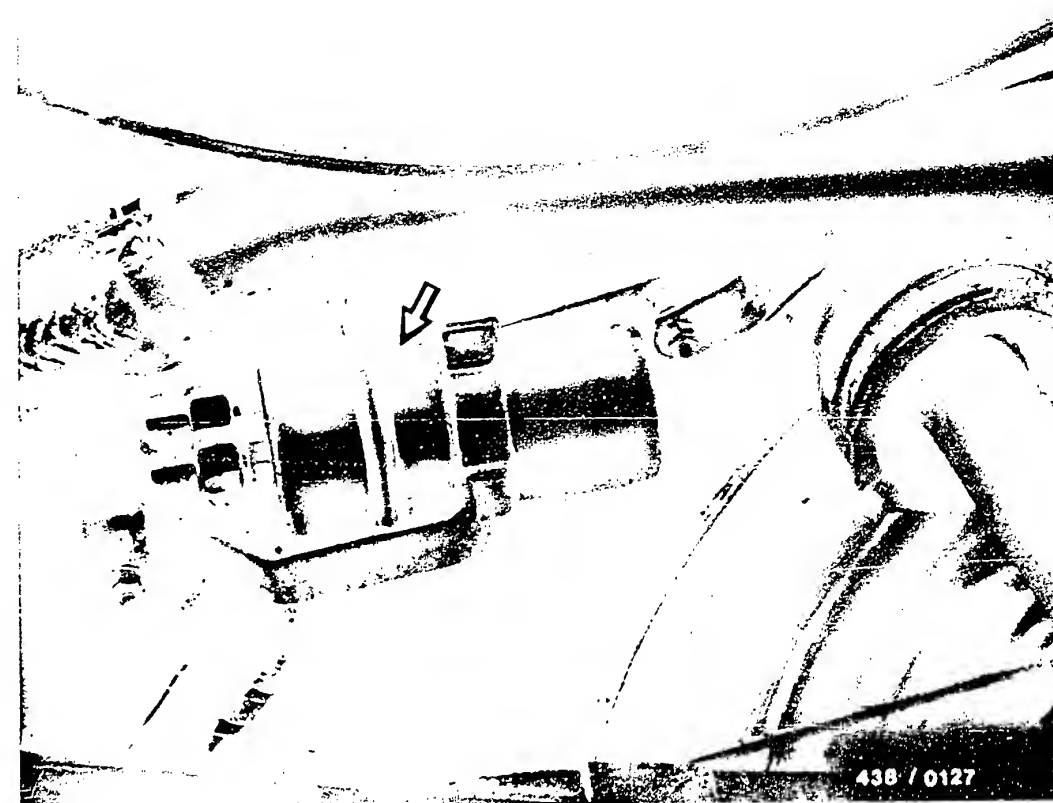
1 = Start valve  
2 = Throttle-valve switch  
3 = Mixture-control unit

4 = Fuel filter  
5 = Warm-up regulator





- 1 = Idle-speed bypass screw
- 2 = Thermo-time switch
- 3 = Injection valves
- 4 = Auxiliary-air device
- 5 = Start valve



#### Fuel supply system components

The fuel accumulator (arrow) is located on a support above the rear axle on the right-hand side of the vehicle as seen in the forward direction of travel. Since the installation location is exposed to a great deal of dirt, the accumulator connection should be thoroughly cleaned before loosening.

The in-tank electric fuel pump with exchangeable non-return valve and screwed-on pressure damper is accessible by way of the closure ring on the upper side of the fuel tank.

#### Additional components

The electronic relay for the safety circuit is housed in the central electrics on the left beneath the instrument panel.

Trouble-shooting instructions : PEU-5004  
BOSCH system : LE-2-Jetronic  
Make of vehicle : PEUGEOT  
Basic microcard : PEU-502

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the vehicle models with 1.580 l/4-cyl. engine:

Peugeot 205 1.6 Injection 01.86->  
Peugeot 309 1.6 Injection 03.86->  
EU version

- \* LE2-Jetronic with 25-pin control unit:  
0 280 000 340.
- \* Engine-speed triggering from term. 1 of the ignition coil.
- \* 5-pin air-flow sensor and 7-pin control relay.
- \* Solenoid-operated injection valves with brass-wire coil.
- \* Start control
- \* In-tank electric fuel pump
- \* For measuring the fuel pressure, connect in pressure tester with connection piece KDJE-P 100/14 to fuel-distribution-pipe inlet.

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults. For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

**ATTENTION:** Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

**CAUTION!**

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

- \* Prevent fuel from being injected during the compression test.  
For this reason, disconnect control relay.

For further precautionary measures,  
see basic instructions.

## TROUBLE-SHOOTING CHART

**Customer complaint (symptom of trouble)**

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

|   |   |   |   |   |   |   |   |   |                                    |
|---|---|---|---|---|---|---|---|---|------------------------------------|
|   |   |   |   |   |   |   |   |   | Cause (component fault)            |
| * | * | * | * | * | * | * | * | * | Universal test adapter             |
| * |   |   |   |   |   |   |   |   | Electric fuel pump                 |
| * | * | * | * |   |   |   |   |   | Auxiliary-air device/idle actuator |
| * | * | * | * | * | * | * | * | * | Air-flow sensor/air-mass sensor    |
| * | * | * | * |   | * |   |   |   | Intake system                      |
|   |   | * | * | * |   | * | * |   | Solenoid-operated injection valves |
| * | * | * |   |   | * | * |   |   | Fuel pressure                      |
|   |   |   |   | * | * |   |   |   | Fuel quantity                      |
|   |   | * | * | * | * | * |   |   | Throttle valve                     |
|   |   |   |   | * |   |   |   |   | Overrun cut-off                    |
| * |   | * |   |   |   |   |   |   | Start control                      |
|   |   |   |   | * |   |   |   |   | Ground                             |
| * | * | * | * | * | * |   |   |   | Alternator, interference suppress. |
|   |   | * | * | * |   | * |   |   | CO exhaust-gas adjustment          |
|   |   |   |   | * |   |   |   |   | Control unit                       |

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01  
 Adapter lead: 1 684 463 123

| Test step | Switch |    | Termi-<br>nals   | Testing of<br>component/function                         | Test instructions/<br>Test conditions              | Set values                                  |
|-----------|--------|----|------------------|--|--|---|
| 1         | 5      | —  | 1 - 5            | Voltage pulses from<br>ignition coil term. 1             | Shift into neutral, start engine                   | Ignition pulses on<br>oscilloscope          |
| 2         | 6      | —  | 9 - 5<br>(+) (-) | Voltage from control<br>relay term. 87                   | Shift into neutral, start engine                   | 8...15 V                                    |
| 3         | 7      | —  | 4 - 5<br>(+) (-) | Voltage from ignition<br>and starting switch<br>term. 50 | Shift into neutral, start engine                   | 8...15 V                                    |
| 4         | <br>V  | 11 | 8 - 5            | Resistor set<br>in air-flow sensor                       | —  | 100...200 $\Omega$                          |
| 5         | <br>V  | 12 | 7 - 5            | Resistance of potentio-<br>meter in air-flow<br>sensor   | Deflect air-flow sensor flap as far as it will go. | 60...1000 $\Omega$                          |
| 6         | <br>V  | 13 | 10 - 5           | Resistance, temperature<br>sensor (engine)               | +15...+30°C:<br>Approx. +80°C:                     | 1,45...3,3 k $\Omega$<br>280...360 $\Omega$ |
| 7         | <br>V  | 14 | 13 - 5           | Frame connection of<br>output stage                      |  | 0...10 $\Omega$                             |



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01  
Adapter lead: 1 684 463 123

| Test step | Switch |          | Termi-<br>nals | Testing of<br>component/function  | Test instructions/<br>Test conditions  | Set values                                |
|-----------|--------|----------|----------------|---|--|---|
|           | V      | $\Omega$ |                |   |  |   |
| 8         | <br>V  | 16       | 2 - 9          | Resistance of<br>idle contact   | Accelerator pedal in rest position :<br>Slightly depress accelerator pedal : | 0...10 $\Omega$<br>infinity $\Omega$      |
| 9         | <br>V  | 17       | 3 - 9          | Resistance of<br>full-load contact  | Accelerator pedal in rest position :<br>Fully depress accelerator pedal :    | infinity $\Omega$<br>0...10 $\Omega$      |
| 10        | <br>V  | 18       | 12 - 9         | Resistance of shunt-<br>connected solenoid-oper-<br>ated injection valves | +15...+30°C :<br>Approx. +80°C :   | 7,0...9,5 $\Omega$<br>7,2...10,0 $\Omega$ |

REMARK : Following components with respective connecting leads are not covered by the universal test adapter in the test:

1. Auxiliary-air device:
- Positive lead from term. 87 of control relay,
- negative lead to engine ground.
2. Electric fuel pump:
- Positive lead from term. 87b of control unit (via pump fuse),
- negative lead to vehicle ground.

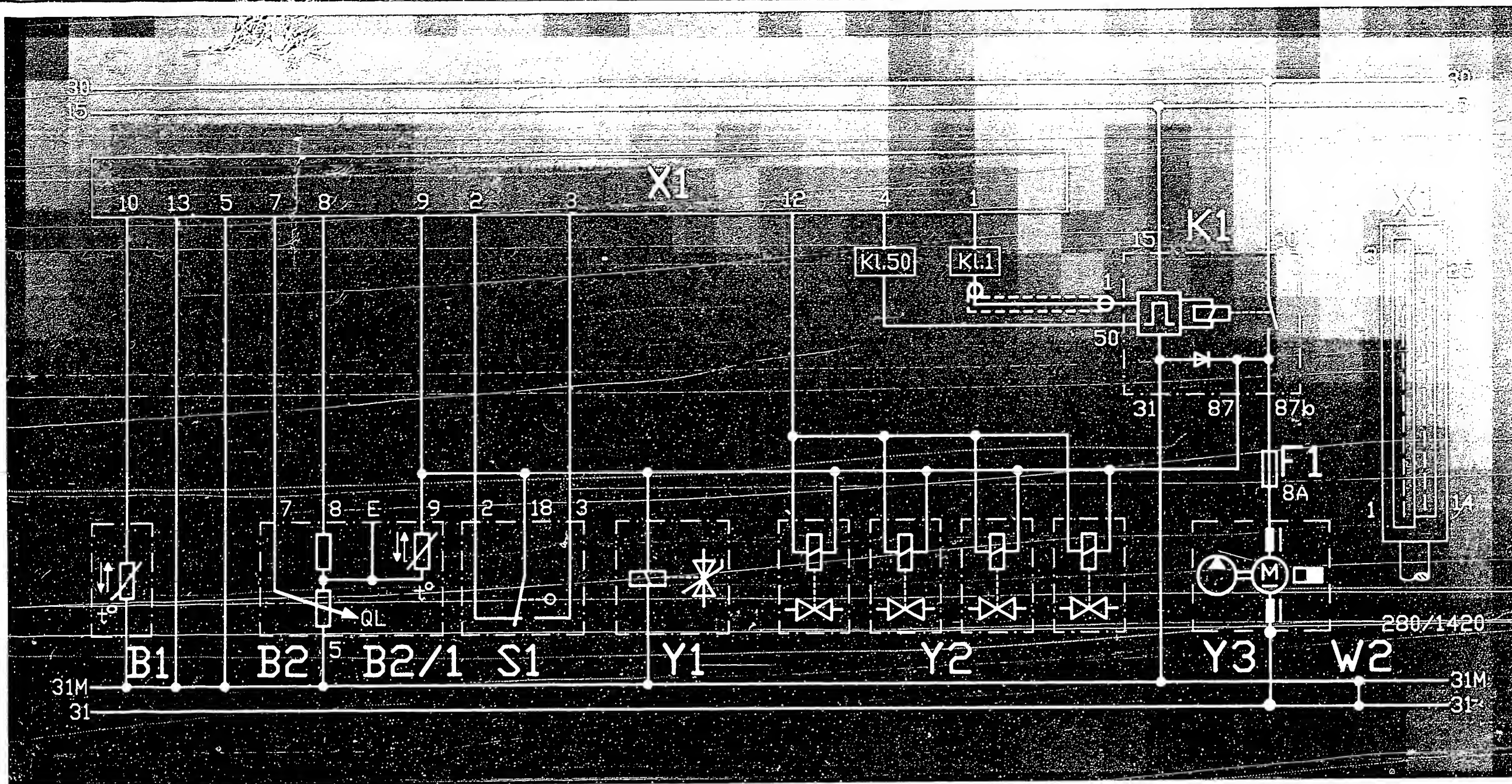
## TEST SPECIFICATIONS

| Component/function  | Set values                         |
|---|------------------------------------|
| Electric fuel pump  |                                    |
| * Fuel delivery and return:                                       | at least 700 cm <sup>3</sup> /30 s |
| * Supply voltage under load:                                      | at least 12 V                      |
| Pressure regulator  |                                    |
| * Fuel pressure with engine at standstill:                        | 2,8...3,2 bar                      |
| at idle:  | approx. 0.5 bar lower              |
| Fuel system, leakages   |                                    |
| * Fuel pressure after 20 mins. with engine at standstill:         | at least 1.0 bar                   |
| Auxiliary-air device  |                                    |
| * Resistance value  | 40...75 $\Omega$                   |
| Air-flow sensor   |                                    |
| * Resistance value between  |                                    |
| term. 8 and term. 5:  | 340 ... 450 $\Omega$               |
| term. 7 and term. 5:  | 60 ... 1000 $\Omega$ 1)            |
| term. 9 and term. 5:  | 500 ... 760 $\Omega$               |
| term. 8 and term. 9:  | 160 ... 300 $\Omega$               |
| 1) (Fully deflect air-flow sensor flap)                           |                                    |
| Temperature sensor (engine)                                       |                                    |
| * Internal electrical resistance at ambient temperature           |                                    |
| +15...+30°C:  | 1,45...3,3 k $\Omega$              |
| With engine at warm. op. temp. approx. +80°C :                    | 280...360 $\Omega$                 |
| Lambda-sensor heater  |                                    |
| * Internal electrical resistance (PTC) with engine at standstill: | 1...15 $\Omega$                    |

## TEST SPECIFICATIONS (Continued)

| Component/Function   | Set values                  |
|--|-----------------------------|
| Solenoid-operated injection valve  |                             |
| * Internal electrical resistance at ambient temperature                  |                             |
| +15...+30°C:   | 14.5...17.5 $\Omega$        |
| * Leakage after 60 s:  | no drop must fall           |
| Start control  |                             |
| * Voltage at injection valve on initiation of starting:                  | greater than 1.5 V          |
| after approx. 15s.:  | approx. 0.5 V               |
| Idle-speed adjustment, engine at normal operating temp., approx. + 80° C |                             |
| * Idle speed:  | 850...950 min <sup>-1</sup> |
| * CO content:  | 1,0...2,0 vol. %            |

See equipment and Autodata microcards for settings for ignition, valve clearance and other engine-related data.



# ELECTRICAL TERMINAL DIAGRAM

B1 = Temperature sensor (engine)

B2 = Air-flow sensor

B2/1= Temperature sensor (intake air)

F1 = Fuse (electric fuel pump)

K1 = Control relay

S1 = Throttle-valve switch

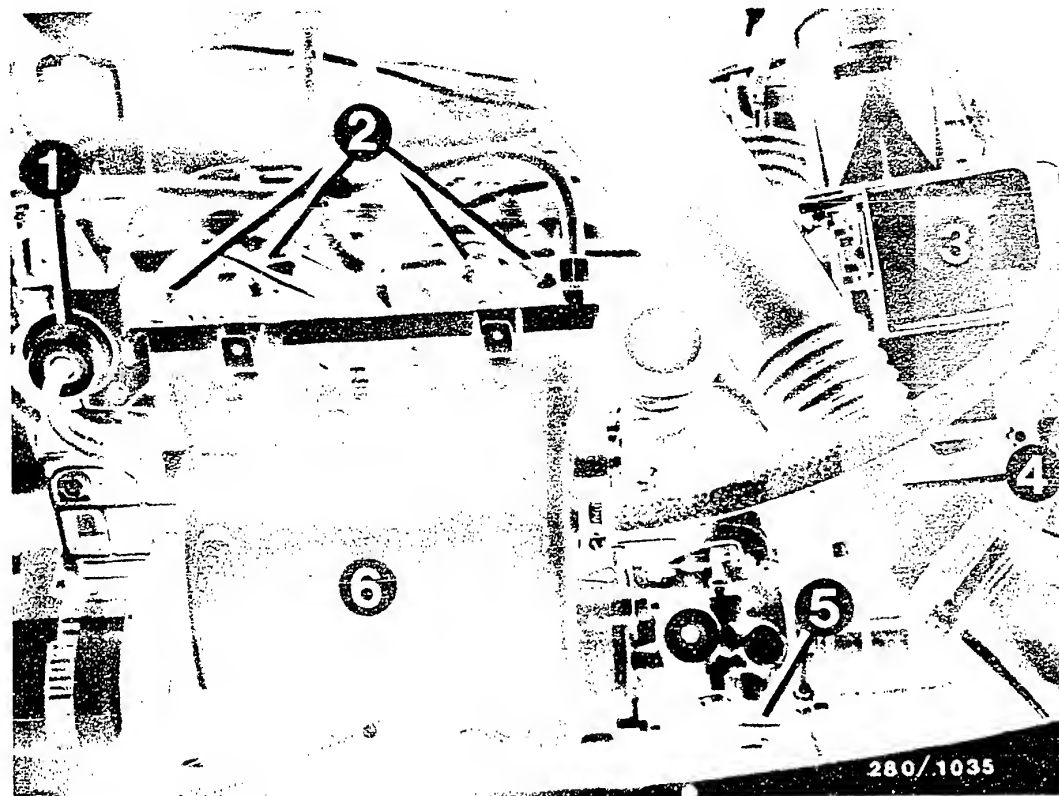
W2 = Ground strap, engine

X1 = Control-unit plug

Y1 = Auxiliary-air device

Y2 = Solenoid-operated injection valve

Y3 = In-tank electric fuel pump



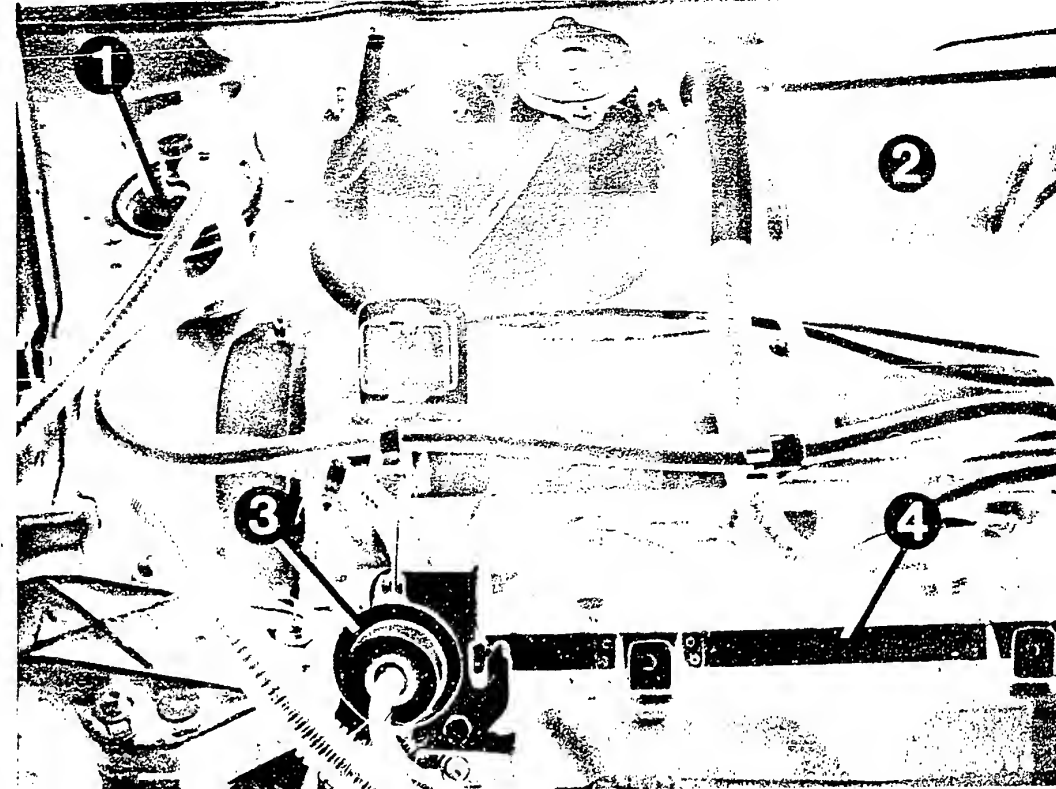
- 1 = Pressure regulator
- 2 = Solenoid-operated injection valves  
with O-ring sealing technique
- 3 = Air-flow sensor
- 4 = Air guide
- 5 = Throttle-valve switch
- 6 = Intake manifold

#### INSTALLATION POSITION OF COMPONENTS

Further components not illustrated

All indications "right" and "left" always refer to the forward direction of travel.

- \* Control unit : on passenger's side above the glove compartment.
- \* Auxiliary-air device: beneath the ignition distributor on the left-hand side of the engine block.
- \* Temperature sensor (engine): on the left-hand side of the engine block next to the auxiliary-air device.

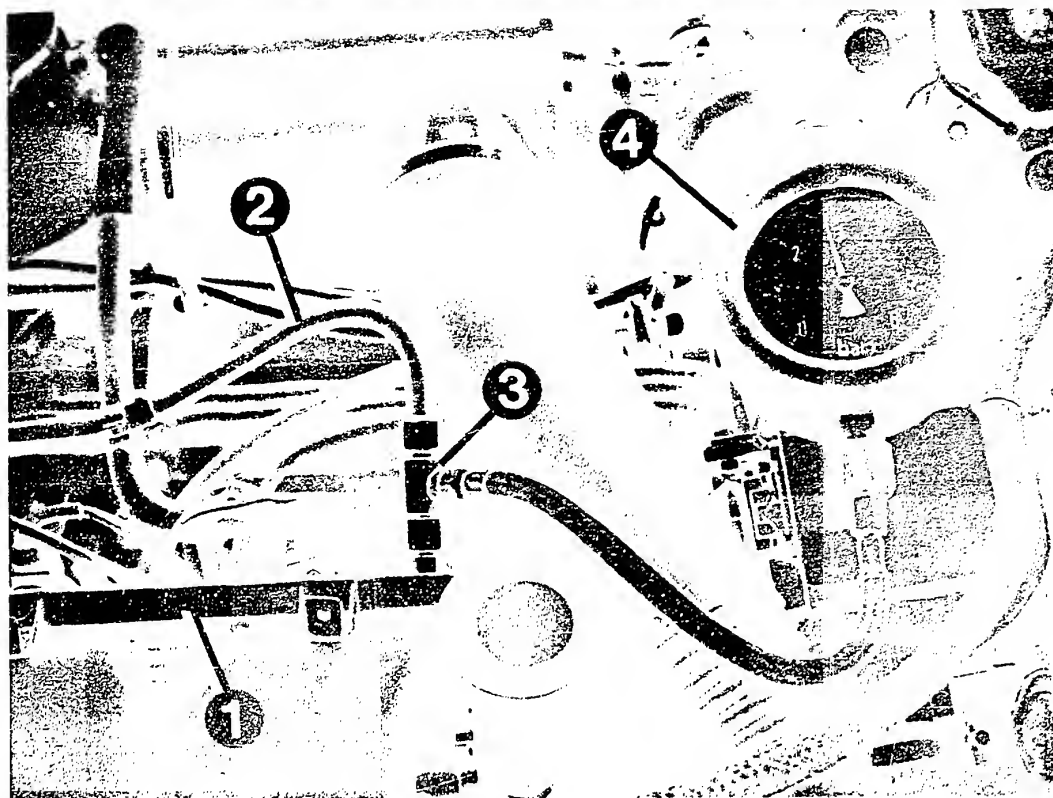


- 1 = Fuel filter
- 2 = Air filter
- 3 = Pressure regulator
- 4 = Fuel-distribution pipe

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Further components not illustrated

- \* Control relay: in front of the battery on the vehicle frame. Protected against splash-water by hood.
- \* Central ground: above the control relay
- \* In-tank fuel pump, together with a strainer, is mounted vertically on the bracket which in turn is bolted on top of the fuel tank.



- 1 = Fuel-distribution pipe
- 2 = Fuel-injection tubing, supply
- 3 = Connecting piece KDJE-P100/14
- 4 = Pressure gauge of pressure tester  
KDJE-P 100

#### TESTING THE FUEL PRESSURE

For testing the fuel pressure, use pressure gauge and hose line of pressure tester KDJE-P 100.

Connect in connecting piece KDJE-P 100/14 at the fuel-distribution pipe inlet and connect hose line with pressure gauge to the threaded connector at side.

Attention. When opening the fitting, make sure that no fuel gets on to any hot parts of the engine.

For production reasons:  
continued on the following  
coordinate.



Trouble-shooting instructions : AUD-5005  
BOSCH system : K-Jetronic  
Make of vehicle : Audi 90  
Basic microcard : AUD-01/J2

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## SPECIAL FEATURES

- \* These instructions contain the K-Jetronic trouble-shooting instructions, valid at the time of publication, for the following Audi models:

Audi 90 Quattro, Coupé, Coupé Quattro  
Engine KV, HY / 2.3 l / 5 cyl.  
10.85->

- \* Updraft mixture-control unit
- \* Injection valves with air shrouding
- \* Warm-up regulator for intake-manifold-pressure-dependent full-load enrichment.
- \* Impulse relay for activation of the cold-start valve during warm starting.
- \* Pressure-surge switch for cold-acceleration enrichment
- \* Overrun cut-off and idle stabilization

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!  
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For testing the compression, disconnect pump relay in order to prevent undesired injection by the injection valves.

Important information with regard to working on the K-Jetronic.

If any fuel connections are loosened or components removed, also from the vacuum system, always use new seals when re-connecting or remounting.

When working on the K-Jetronic, be sure to keep everything clean. Clean the external areas of the fuel connections thoroughly before loosening them.

While testing with the electric fuel pump running, never deflect (lift) the air-flow sensor plate, since this leads to fuel being injected via the injection valves. This can lead to serious damage to the engine when it is started subsequently.



TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

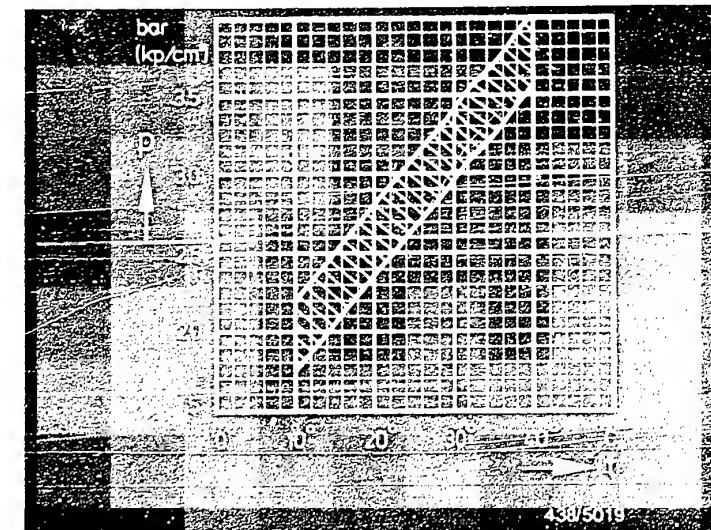
- Starting motor operates, but engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Rough idling (engine speed, exhaust gas).
- Poor throttle response, flat spot during acceleration.
- Engine misfiring (ignition, fuel injection).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine running on (dieseling).
- Engine pinging/knocking
- Engine overheating.
- Fault lamp.

| Cause (component fault) |   |   |   |   |   |   |   |  |  |                       |
|-------------------------|---|---|---|---|---|---|---|--|--|-----------------------|
| *                       | * |   |   | * |   |   |   |  |  | Electric fuel pump    |
| *                       |   | * | * | * |   |   |   |  |  | Intake system         |
| *                       |   |   |   |   |   |   |   |  |  | Fuel system           |
| *                       |   | * | * | * | * | * |   |  |  | Fuel distributor      |
| *                       |   | * | * | * | * | * |   |  |  | Air-flow sensor       |
| *                       |   | * |   |   |   | * | * |  |  | Cold-start system     |
| *                       |   | * |   | * |   | * |   |  |  | Injection valves      |
|                         | * |   | * | * | * |   |   |  |  | Primary pressure      |
| *                       | * | * | * | * | * | * |   |  |  | Control pressure      |
| *                       |   | * | * | * | * |   |   |  |  | Fuel dispersion       |
|                         |   |   |   |   | * |   |   |  |  | Throttle valve        |
| *                       | * | * | * | * | * | * |   |  |  | Overrun cut-off       |
| *                       |   | * |   |   |   |   |   |  |  | Idle stabilization    |
| *                       |   | * | * |   |   | * | * |  |  | Idle-speed adjustment |

For production reasons:  
continued on the following  
coordinate.

## TEST SPECIFICATIONS

| No. | Testing/Test condition  | Set value  |
|-----|---|--|
| 1   | Electric fuel pump – fuel delivery:<br>Supply voltage (under load):   | at least: 1600<br>cm <sup>3</sup> /min<br>at least: 11,5 V   |
| 2   | Fuel delivery – control–pressure circuit;   | 160...240 cm <sup>3</sup> /min   |
| 3   | Fuel distributor – primary pressure:<br>Test specification:<br>Setting:   | 5,2...5,9 bar<br>5,4...5,6 bar   |
| 4   | Control pressure:<br>Take the "cold" control pressure corresponding to the ambient temperature measured from the chart opposite. For testing, connect vacuum pump to intake–manifold–pressure connection of the warm–up regulator.<br>Setting: 400...600 mbar<br><br>"Warm" control pressure.<br><br>Test with atmospheric pressure (no vacuum).<br>Test specification:<br><br>Test with intake–manifold vacuum. Connect vacuum pump to intake–manifold connection of warm–up regulator.<br>Setting: 400...600 mbar<br>Test specification:<br><br>Leakage test of full–load diaphragm.<br>Maximum pressure drop from setting: | <br><br><br><br><br><br><br><br><br><br>2,6...3,0 bar<br><br><br><br><br><br><br><br><br><br>4,0...4,4 bar<br><br><br><br><br><br><br><br><br><br>100 mbar/15s |
| 5   | Leakage test – total system:<br><br>Minimum pressure after 10 mins.:<br>Minimum pressure after 20 mins.:  | <br><br>3,4 bar<br>3,3 bar   |



p = Control pressure (gauge pressure)  
t = Ambient temperature

## TEST SPECIFICATIONS (CONTINUED)

| No. | Testing/Test condition  | Set value  |  |
|-----|---|--|--|
| 6   | Injection valves - opening pressure:<br><br>Leakage test not below 3,5 bar:<br>No drop must fall within 25 s.                                       | 3,7...4,8 bar  |  |
| 7   | Fuel delivery - comparative measurement:<br><br>Idle:<br>Part-load:<br>Full-load:<br><br>Minimum delivery at max. air-flow sensor plate deflection: | Setting point:<br>(cm <sup>3</sup> /min)               | Max. allowable delivery<br>(cm <sup>3</sup> /min)      |
|     |   | 6,0<br>40,0<br>122                                     | 6,6<br>42,8<br>134                                     |
|     |   | 122 cm <sup>3</sup> /min                               |  |
| 8   | Thermo-time switch - resistance measurement:<br><br>Terminal G and ground:<br>Terminal W and ground:<br>Terminal G and terminal W:                  | below + 30° C<br>50...70 Ω<br>0 Ω<br>50...70 Ω         | above + 40° C<br>50...70 Ω<br>infinity Ω<br>infinity Ω |
| 9   | Idle-speed adjustment*<br><br>Idle speed:<br><br>CO content:  | 750...830 min <sup>-1</sup><br><br>% by vol. 0,8...1,2 |  |

## \* Notes on idle-speed adjustment:

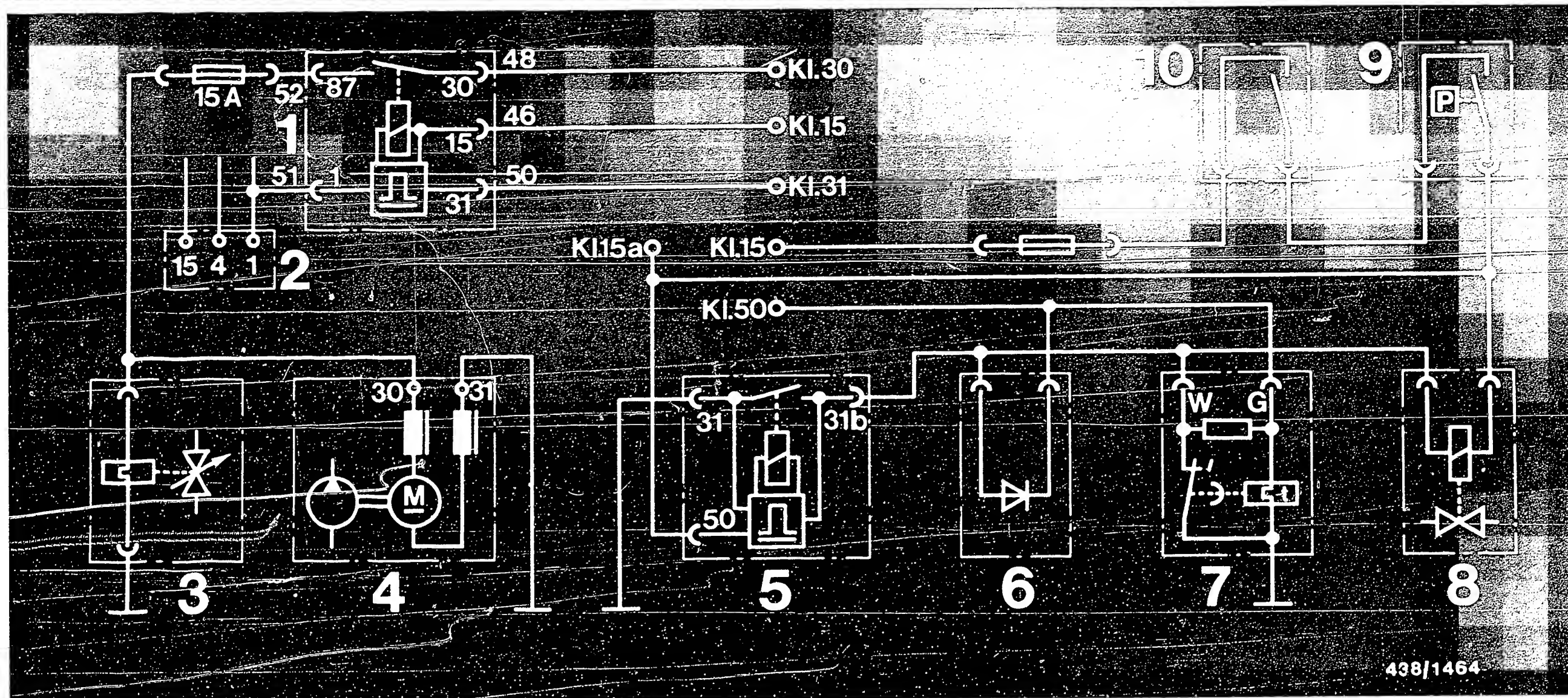
The idle speed cannot be adjusted. If necessary, see the basic instructions for testing the idle stabilization.

Engine-oil temperature at least 80 °C.

Hose for crankcase ventilation disconnected and positioned so that only fresh air can be inducted.

All electrical consuming devices switched off.

The radiator fan must not operate.



438/1464

# ELECTRICAL TERMINAL DIAGRAM

- |                        |                                 |
|------------------------|---------------------------------|
| 1 = Fuel-pump relay    | 6 = Blocking diode              |
| 2 = Ignition coil      | 7 = Thermo-time switch          |
| 3 = Warm-up regulator  | 8 = Cold-start valve            |
| 4 = Electric fuel pump | 9 = Pressure-surge switch       |
| 5 = Impulse relay      | 10 = Throttle-valve microswitch |



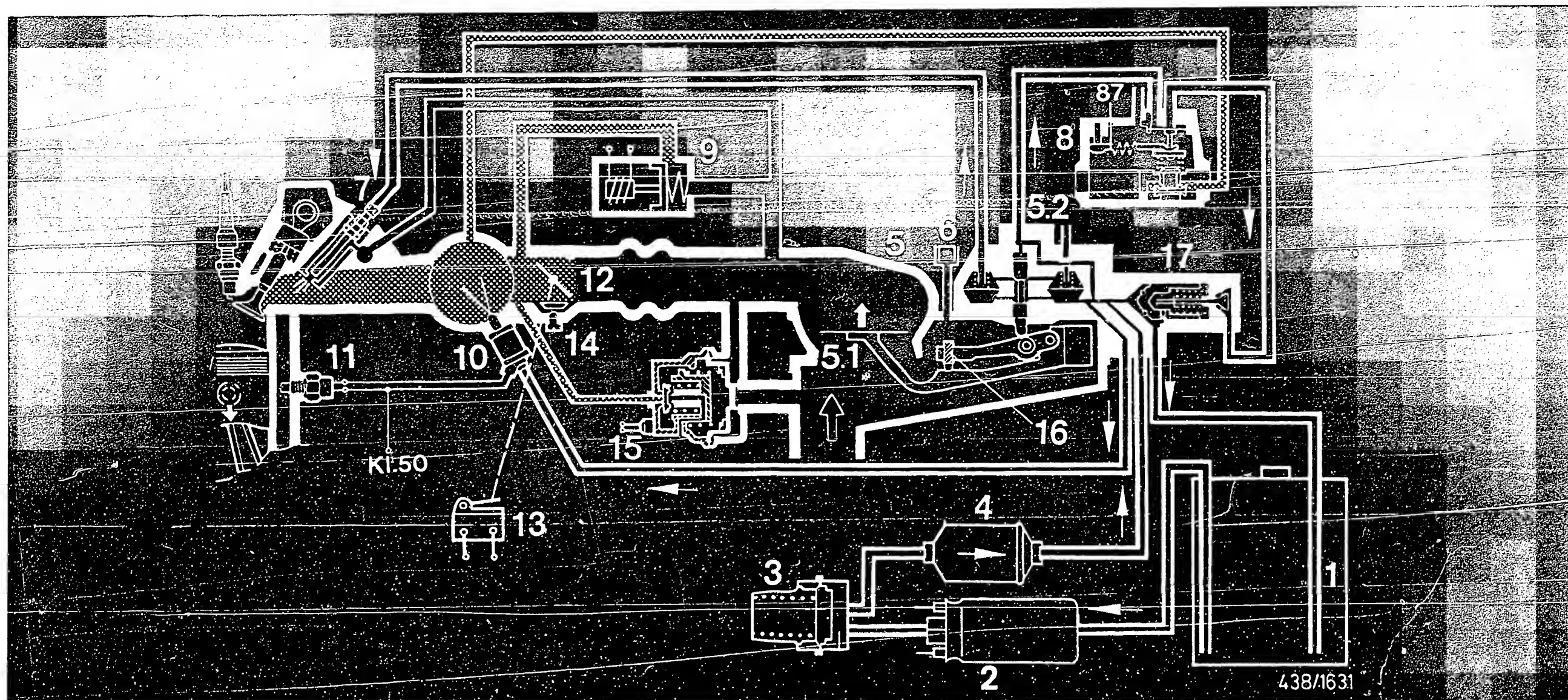
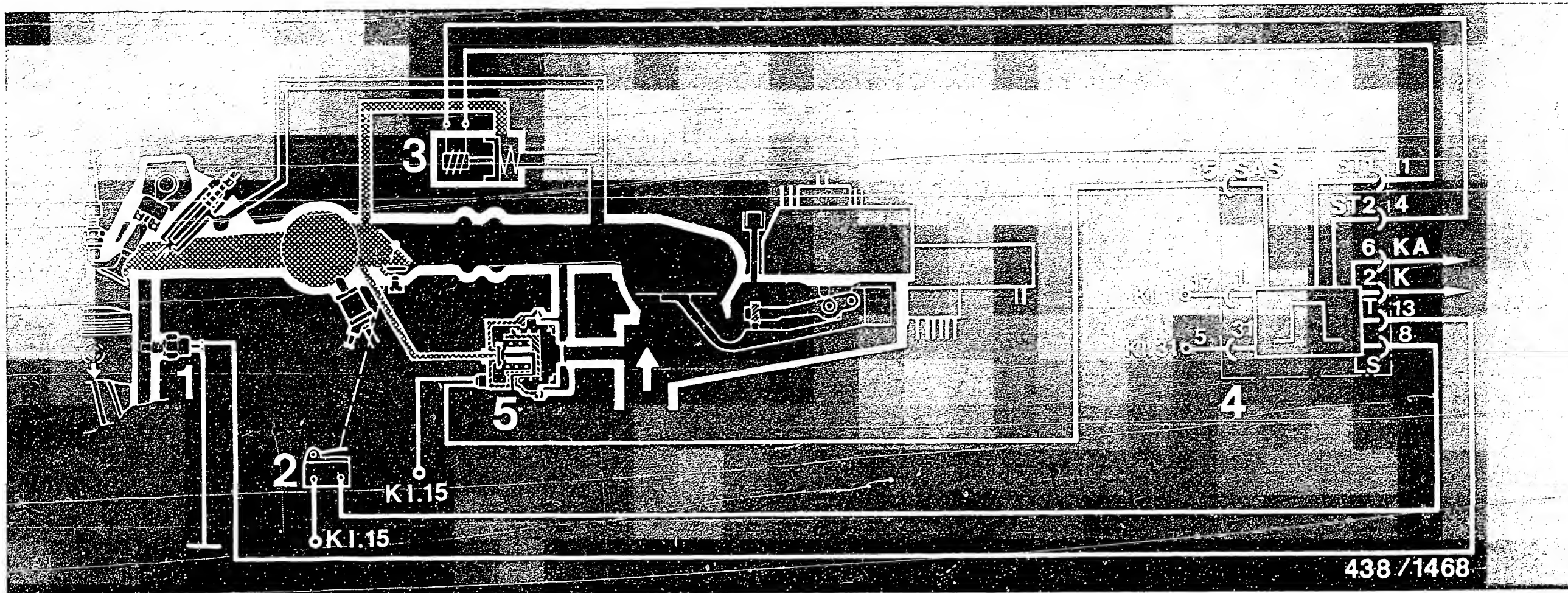


DIAGRAM OF AIR/FUEL LINES

- |                          |   |
|--------------------------|---|
| 1 = Fuel tank            | 9 = Idle actuator                               |
| 2 = Electric fuel pump   | 10 = Cold-start valve                           |
| 3 = Fuel accumulator     | 11 = Thermo-time switch                         |
| 4 = Fuel filter          | 12 = Throttle valve                             |
| 5 = Mixture-control unit | 13 = Throttle-valve microswitch                 |
| 5.1 = Air-flow sensor    | 14 = Idle-speed bypass screw                    |
| 5.2 = Fuel distributor   | 15 = Overrun-cutoff valve                       |
| 6 = Fuse cap             | 16 = Idle-mixture-adjusting screw               |
| 7 = Injection valve      | 17 = Primary-pressure regulator with push valve |
| 8 = Warm-up regulator    |   |



- 1 = Thermo-switch
- 2 = Throttle-valve microswitch
- 3 = Idle actuator

- 4 = Control unit for idle stabilization and overrun cut-off
- 5 = Overrun-cutoff valve

#### IDLE STABILIZATION AND OVERRUN CUT-OFF (NON-BOSCH PRODUCT)

The control unit for idle stabilization and overrun cut-off is located on the auxiliary-relay plate beneath the switchboard on the left.

#### Operating principle, idle stabilization

The idle speed is stabilized by the electronic control unit and the idle actuator. Instead of the auxiliary-air device which is usually fitted, the idle actuator is installed in the air bypass to the throttle valve.

The tractive electromagnet of the idle actuator is supplied with a variably pulsed voltage at a constant frequency by the control unit. In this way, the screen in the air duct is adjusted and the air throughflow changed.

## OPERATING PRINCIPLE, OVERRUN CUT-OFF

The control valve of the overrun-cutoff valve is connected to term. 15 and to term. 15 /SAS (overrun cut-off) of the control unit.

The control valve is connected to ground via term. 15/SAS of the control unit under the following conditions:

- \* The coolant temperature is above +30°C.
- \* The engine speed is greater than 1200 min<sup>-1</sup>.
- \* The throttle-valve switch is in the idle position.

If these conditions are fulfilled, the overrun-cutoff valve opens the air-bypass duct.

## INSTALLATION POSITION OF COMPONENTS

- \* Electric fuel pump, fuel accumulator, fuel filter:  
On vehicle floor panel above the rear axle.
- \* Electronic relay:  
In the central electrics on the left beneath the instrument panel.
- \* Idle-speed increase valve:  
In the engine compartment on the firewall next to the battery.
- \* Pressure-surge switch:  
In the engine compartment on the firewall next to the ignition coil.



Trouble-shooting instructions : FOR-5004  
BOSCH system : TZ-I  
Make of vehicle : FORD  
Basic microcard : PKW-031

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| Electrical terminal diagram.....  | 10         |
| Installation position of components with notes on removal and installation..... | 11         |

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of application, apply to the following Ford models:

- \* Fiesta and Escort with OHV engine as of 5.86
- \* Ignition distributor with built-on trigger box (TI-I).
- \* Trigger box 1 227 022 017 for all vehicle models.
- \* Ignition coil 0 221 122 367 or ..031 or competitor's product
- \* The set values given in these brief instructions apply to Bosch products and cannot be used for competitor's products or can at the most be used as a reference value.

## USAGE, STRUCTURE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

Keep persons out of danger.  
Prevent damage to the engine, trigger box or ignition system.

### \* CAUTION !

High-performance ignition system.  
Dangerous primary and secondary voltages.

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

\* When testing the compression, disconnect the trigger-box plug or connect ignition coil term. 4 firmly to ground using auxiliary cable.

### NOTE :

Auxiliary cable must be interference-suppressed with at least 2 k $\Omega$ .

See basic instructions for further precautionary measures.

## TROUBLE-SHOOTING CHART

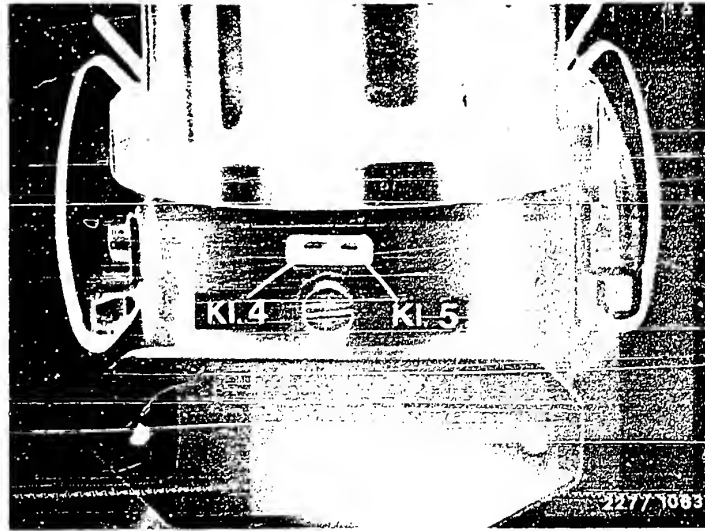
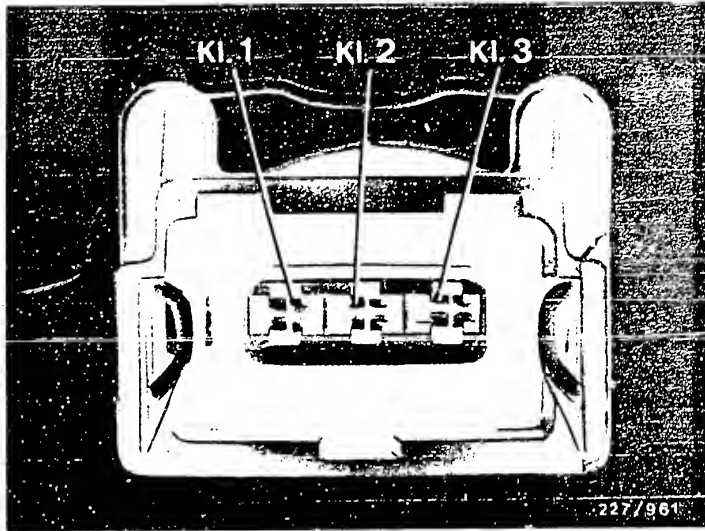
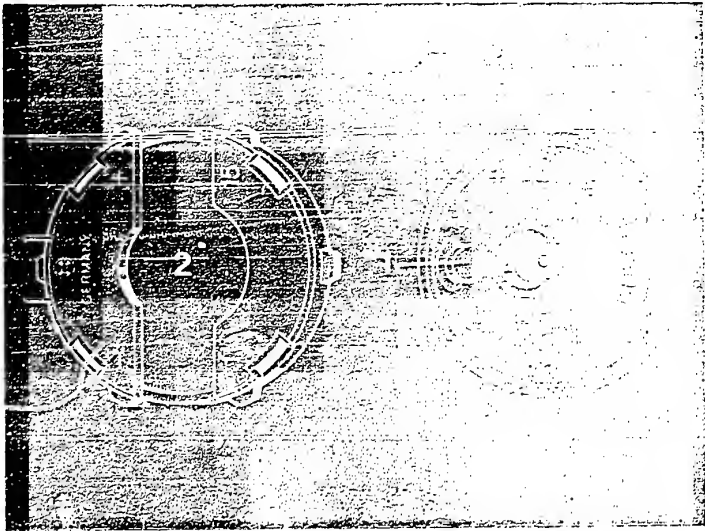
Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel induction).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

|   |   |   |   |   |   |   |   |  |  |  | Cause (component fault)  |
|---|---|---|---|---|---|---|---|--|--|--|--------------------------|
| * | * | * | * | * | * |   |   |  |  |  | High-voltage side        |
| * | * | * | * | * |   |   |   |  |  |  | Ignition coil            |
| * | * |   |   |   |   |   |   |  |  |  | Firing order             |
| * |   |   |   |   |   |   |   |  |  |  | Voltage, trigger box     |
| * |   |   |   |   |   |   |   |  |  |  | Voltage, primary circuit |
| * |   | * | * |   |   |   |   |  |  |  | Magnetic pulse generator |
| * |   |   |   |   |   |   |   |  |  |  | Contact resistances      |
|   | * | * | * | * | * | * | * |  |  |  | Ignition point           |
|   |   |   | * |   |   |   |   |  |  |  | Voltage, trigger box     |
|   |   |   | * |   |   |   |   |  |  |  | Voltage, ignition coil   |
| * |   |   |   |   |   |   |   |  |  |  | Output stage             |
|   |   |   | * |   |   |   |   |  |  |  | Primary voltage          |
|   | * | * |   | * | * | * | * |  |  |  | Centrifugal advance      |
|   | * | * |   | * | * | * | * |  |  |  | Vacuum advance           |

RAPID DIAGNOSIS CHART

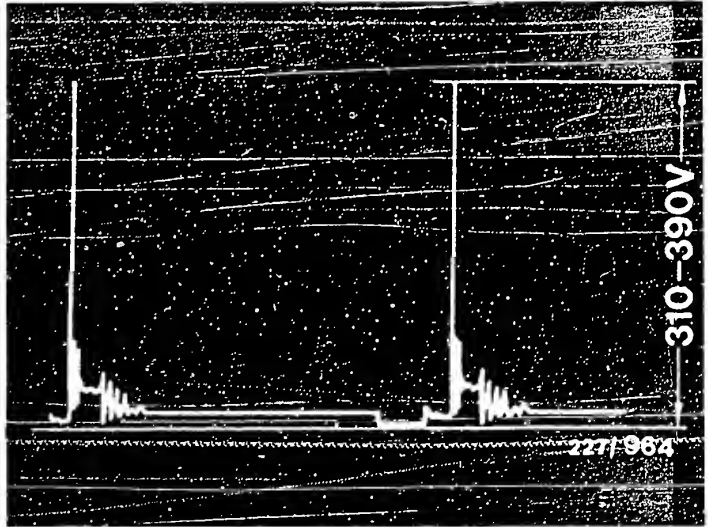
| Test step | Testing of component/function<br>Test instructions/conditions   | Terminals                  | Set values   |
|-----------|---|----------------------------|--|
| 1         | HIGH-VOLTAGE SIDE. Visual examination<br>(distributor cap, ignition harness etc.)<br>Ignition oscillogram   | —                          | —  |
| 2         | IGNITION COIL. Visual examination, plug fitted,<br>sealing compound escaped?<br>Ignition coil ...031      Resistance, primary<br>Resistance, secondary<br>Ignition coil ...367      Resistance, primary<br>Resistance, secondary  | 1 15<br>1 4<br>1 15<br>1 4 | 0,6...1,1 $\Omega$<br>4,4...8,7 k $\Omega$<br>1,0...1,7 $\Omega$<br>3,2...5,6 k $\Omega$ |
| 3         | VOLTAGE SUPPLY, TRIGGER BOX<br>Ignition ON. Voltage, trigger-box plug   | 3 2<br>+ —                 | Approx. batt. +ve  |
| 4         | PRIMARY CIRCUIT<br>Ignition ON. Voltage, trigger-box plug   | 1 2<br>+ —                 | Approx. batt. +ve  |
| 5         | MAGNETIC PULSE GENERATOR<br>The trigger box must be removed from the<br>ignition distributor for the following tests.<br><br>1. Visual examination (mechanical damage),<br>timer core must not rub against generator<br>teeth.<br><br>2. Winding resistance, ignition-distributor<br>plug-in connection.<br><br>3. Insulation resistance, ignition-distributor<br>plug-in connection. | 4 5<br><br>4 31<br>5 31    | 900...1600 $\Omega$<br><br>Infinity $\Omega$   |



RAPID DIAGNOSIS CHART (CONTINUED)

| Test step | Testing of component/function<br>Test instructions/conditions  | Termi-<br>nals | Set values                             |
|-----------|--|----------------|--|
| 6*        | CONTACT RESISTANCES<br>Check voltage-supply leads of trigger box and primary circuit for contact resistance.               | —              | Max. 0.3 $\Omega$                      |
| 7         | Adjust IGNITION POINT.   | —              | Autodata test specifications           |
| 8         | VOLTAGE SUPPLY, TRIGGER BOX<br>Engine at idle. Voltage, trigger-box plug   | 3 2<br>+ -     | 12...14 V, max. 1 V<br>below batt. +ve |
| 9         | VOLTAGE SUPPLY, IGNITION COIL<br>Engine at idle. Voltage, ignition coil and vehicle ground (use adapter for ignition coil) | 15 31<br>+ -   | Min. 10 V                              |
| 10        | OUTPUT STAGE<br>Ignition ON. Voltage, ignition coil  | 15 1<br>+ -    | 0 V                                    |
| 11        | PRIMARY VOLTAGE<br>Voltage, ignition coil with engine at idle  | 15 1<br>+ -    | 310...390 V                            |

\* = Conduct test only when engine is not running.



## TEST SPECIFICATIONS

Ignition coil 0 221 122 031

Primary resistance

0,6...1,1  $\Omega$

Secondary resistance

4,4...8,7 k  $\Omega$

Ignition coil 0 221 122 367

Primary resistance

1,0...1,7  $\Omega$

Secondary resistance

3,2...5,6 k  $\Omega$

Voltage supply

Trigger box with  
engine at idle

12...14 V

Voltage supply

Ignition coil with engine at idle

At least 10 V

Primary voltage

with engine at idle

310...390 V

Magnetic pulse generator

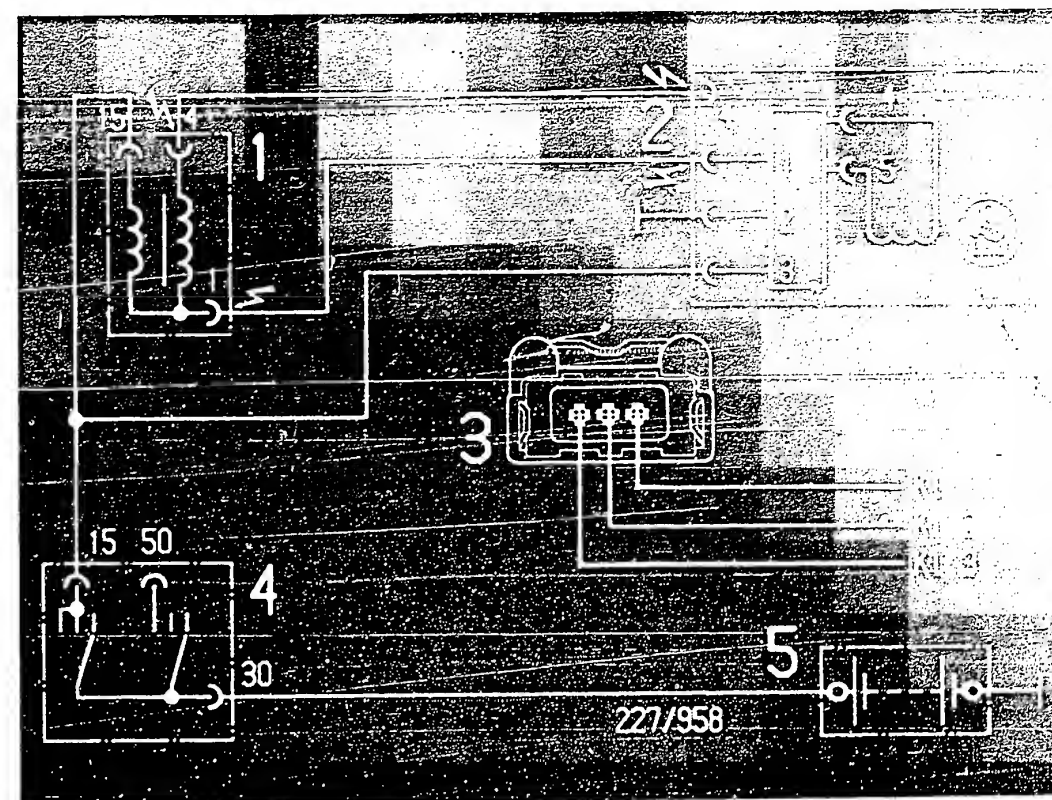
Insulation

Infinity  $\Omega$

Internal resistance

900...1600  $\Omega$

See Autodata test specifications for the settings  
for ignition, idle speed, CO content etc.



High-voltage symbols = Dangerous voltages  
(400 V...25 kV)

1 = Ignition coil

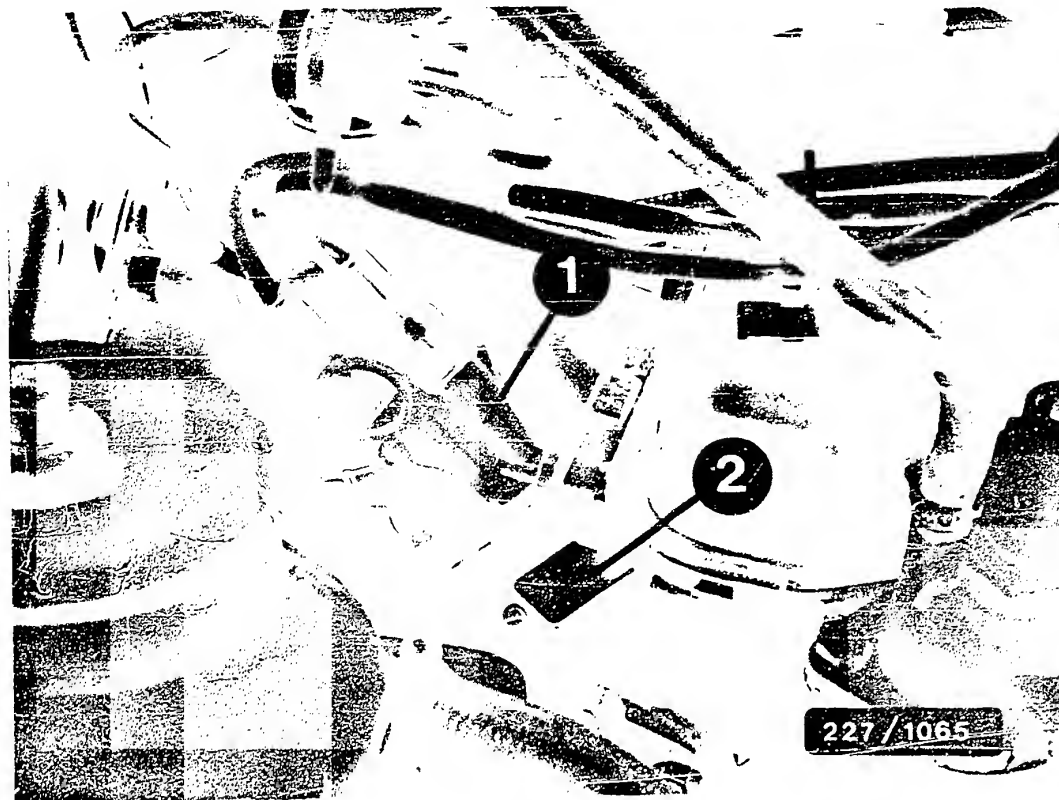
2 = Ignition distributor with trigger box

3 = Trigger-box plug

4 = Ignition and starting switch

5 = Battery

ELECTRICAL TERMINAL DIAGRAM



1 = Ignition distributor

2 = TI-I trigger box

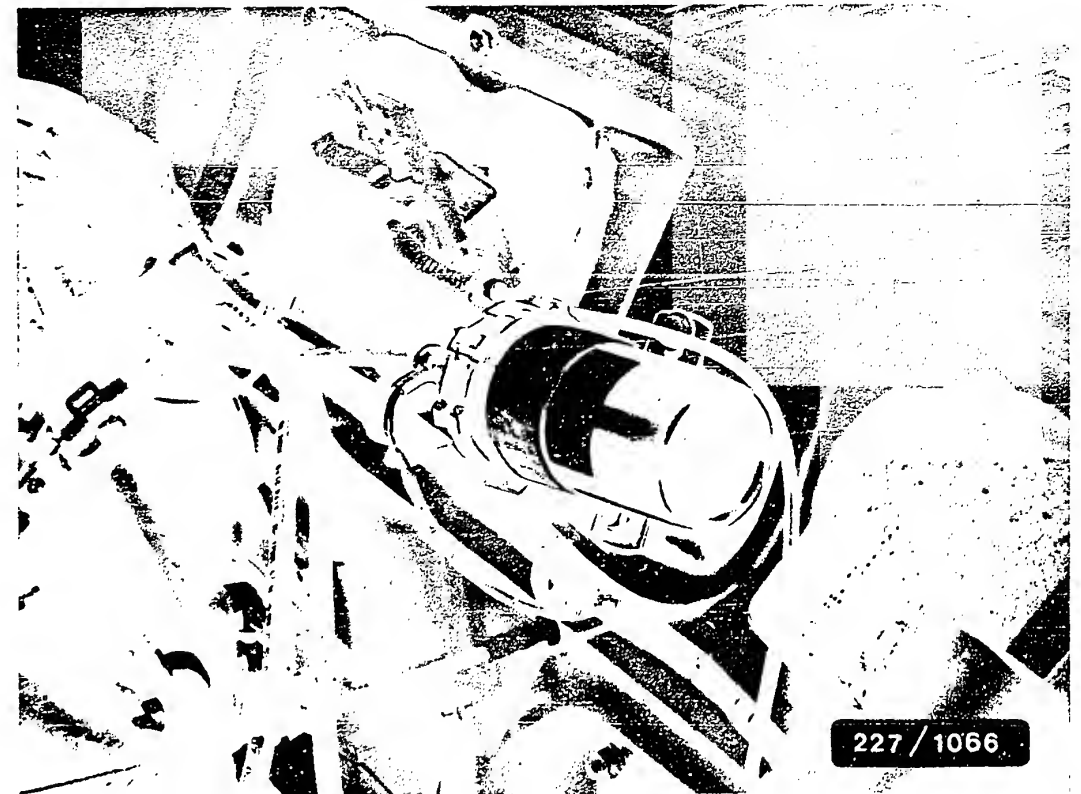
#### Installation position of components

The TI-I trigger box is bolted on to the ignition distributor.

#### Note on removal:

Loosen ignition-distributor mounting.  
Loosen two screws and remove trigger box.

After installing the trigger box, set the ignition point; see Autodata test specifications.



#### INSTALLATION POSITION OF COMPONENTS (Continued)

The ignition coil is bolted on to the firewall of the engine compartment.

Trouble-shooting instructions : CIT-5001  
BOSCH system : TZ-I  
Make of vehicle : CITROEN  
Basic microcard : PKW-031

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| Test specifications.....  | 09         |
| Electrical terminal diagram.....  | 10         |
| Installation position of components with notes on removal and installation..... | 11         |

SPECIAL FEATURES

- These trouble-shooting instructions, valid at the time of application, apply to the following Citroen models:
- AX, AX 11 and AX 14 with engine type TU (33, 37, 40 and 44 kW)
- \* Ignition distributor with built-on trigger box (TI-I).
  - \* Trigger box 0 227 100 140 for all vehicle models.
  - \* Ignition coil 0 221 502 393 or competitor's product
  - \* The set values given in these brief instructions apply to Bosch products and cannot be used for competitor's products or can at the most be used as a reference value.



USAGE, STRUCTURE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/ component faults.

Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Keep persons out of danger.  
Prevent damage to the engine, trigger box or ignition system.

\* C A U T I O N !  
High-performance ignition system.  
Dangerous primary and secondary voltages.

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

\* When testing the compression, disconnect the trigger-box plug or connect ignition coil term. 4 firmly to ground using auxiliary cable.

N O T E :  
Auxiliary cable must be interference-suppressed with at least 2 k Ω .

See basic instructions for further precautionary measures.

TROUBLE-SHOOTING CHART

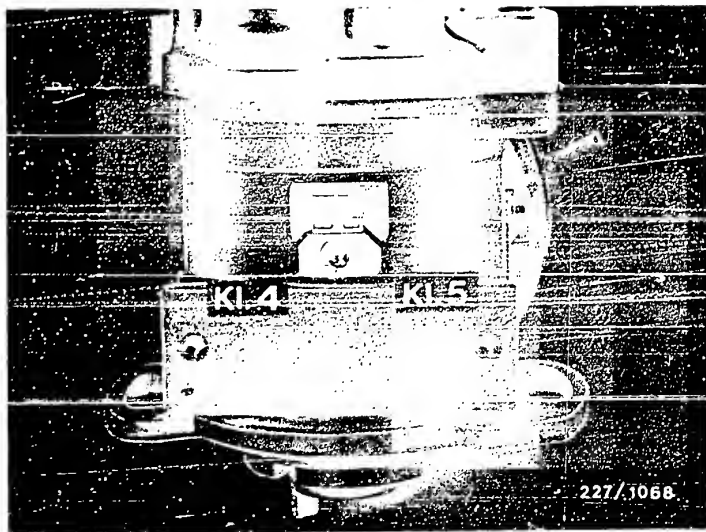
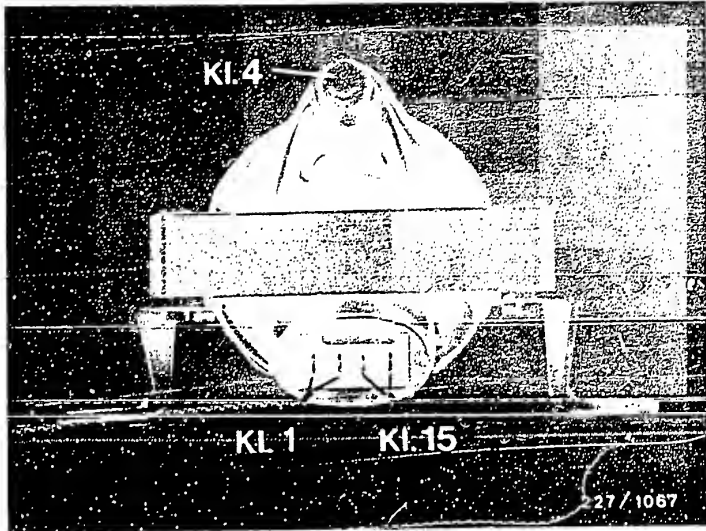
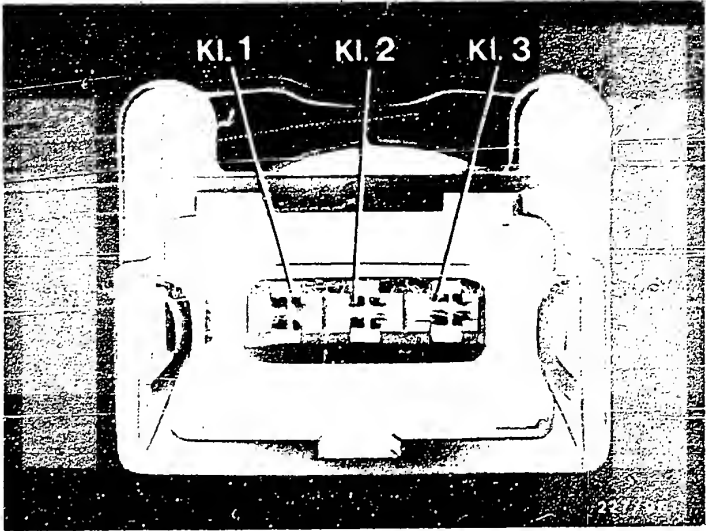
Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel induction).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

| Cause (component fault) |   |   |   |   |   |   |   |  |  |                          |
|-------------------------|---|---|---|---|---|---|---|--|--|--------------------------|
| *                       | * | * | * | * | * |   |   |  |  | High-voltage side        |
| *                       | * | * | * | * |   |   |   |  |  | Ignition coil            |
| *                       | * |   |   |   |   |   |   |  |  | Firing order             |
| *                       |   |   |   |   |   |   |   |  |  | Voltage, trigger box     |
| *                       |   |   |   |   |   |   |   |  |  | Voltage, primary circuit |
| *                       |   | * | * |   |   |   |   |  |  | Magnetic pulse generator |
| *                       |   |   |   |   |   |   |   |  |  | Contact resistances      |
|                         | * | * | * | * | * | * | * |  |  | Ignition point           |
|                         |   |   | * |   |   |   |   |  |  | Voltage, trigger box     |
|                         |   |   | * |   |   |   |   |  |  | Voltage, ignition coil   |
| *                       |   |   |   |   |   |   |   |  |  | Output stage             |
|                         |   |   | * |   |   |   |   |  |  | Primary voltage          |
|                         | * | * |   | * | * | * | * |  |  | Centrifugal advance      |
|                         | * | * |   | * | * | * | * |  |  | Vacuum advance           |

RAPID DIAGNOSIS CHART

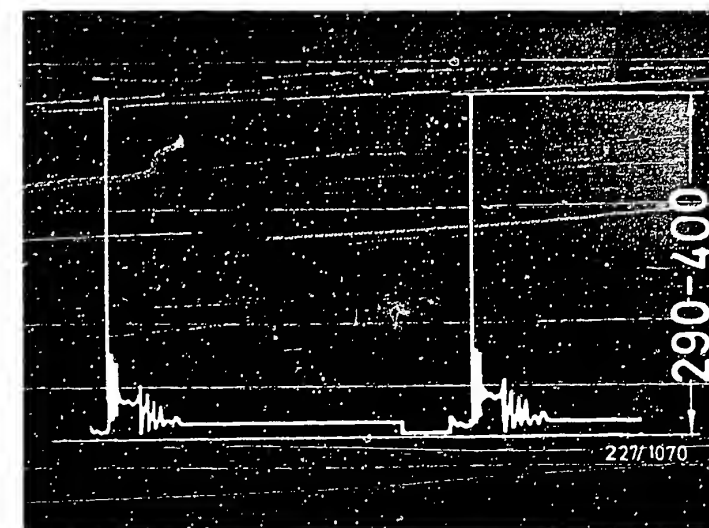
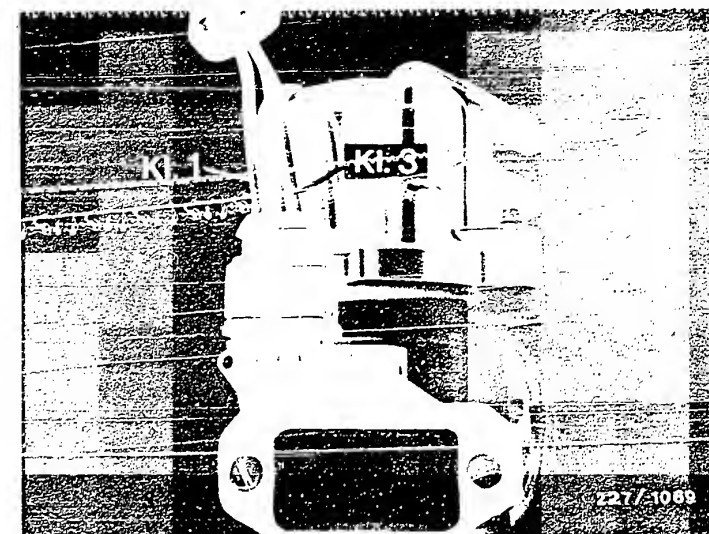
| Test step | Testing of components/function<br>Test instructions/conditions   | Terms.                  | Set values                                  |
|-----------|--|-------------------------|---|
| 1         | HIGH-VOLTAGE END, visual examination<br>(distributor cap, ignition harness etc.)<br>Ignition oscillogram   | —                       | —   |
| 2         | IGNITION COIL, visual examination, plugs present, sealing compound escaped?<br>Resistance, primary<br>Resistance, secondary  | 1 15<br>1 4             | 0,5...0,9 $\Omega$<br>6,6...12,1 k $\Omega$ |
| 3         | VOLTAGE SUPPLY, TRIGGER BOX<br>Ignition ON. Voltage, trigger box plug  | 3 2<br>+ —              | approx. U <sub>B</sub>                      |
| 4         | PRIMARY CIRCUIT<br>Ignition ON. Voltage, trigger box plug  | 1 2<br>+ —              | approx. U <sub>B</sub>                      |
| 5         | MAGNETIC PULSE GENERATOR<br>The ignition distributor must be dismantled from the engine and the trigger box removed for the following tests.<br><br>1. Visual examination (mechanical damage), timer core must not brush against generator teeth.<br><br>2. Winding resistance, ignition-distributor plug connection.<br><br>3. Insulation resistance, ignition-distributor plug connection. | 4 5<br><br>4 31<br>5 31 | 265...465 $\Omega$<br><br>infinite $\Omega$ |



# RAPID DIAGNOSIS CHART (CONTINUED)

| Test step | Testing of component/function<br>Test instructions/conditions  | Terminals | Set values                          |
|-----------|--|-----------|-------------------------------------|
| 6*        | CONTACT RESISTANCES<br>Check voltage-supply leads of trigger box and primary circuit for contact resistance.               | —         | Max. 0.3 $\Omega$                   |
| 7         | Adjust IGNITION POINT.   | —         | Autodata test specifications        |
| 8         | VOLTAGE SUPPLY, TRIGGER BOX<br>Engine at idle. Voltage, trigger-box plug   | 3 + 2 -   | 12...14 V, max. 1 V below batt. +ve |
| 9         | VOLTAGE SUPPLY, IGNITION COIL<br>Engine at idle. Voltage, ignition coil and vehicle ground (use adapter for ignition coil) | 15 + 31 - | Min. 10 V                           |
| 10        | OUTPUT STAGE<br>Ignition ON. Voltage, ignition coil  | 15 + 1 -  | 0 V                                 |
| 11        | PRIMARY VOLTAGE<br>Voltage, ignition coil with engine at idle  | 15 + 1 -  | 290...400 V                         |

\* = Conduct test only when engine is not running.



## TEST SPECIFICATIONS

Ignition coil, primary 0,5...0,9  $\Omega$   
 Ignition coil, secondary 6,6...12,1 k  $\Omega$

Voltage supply  
 trigger box at  
 engine idle 12...14 V

Voltage supply  
 ignition coil at engine idle min. 10 V

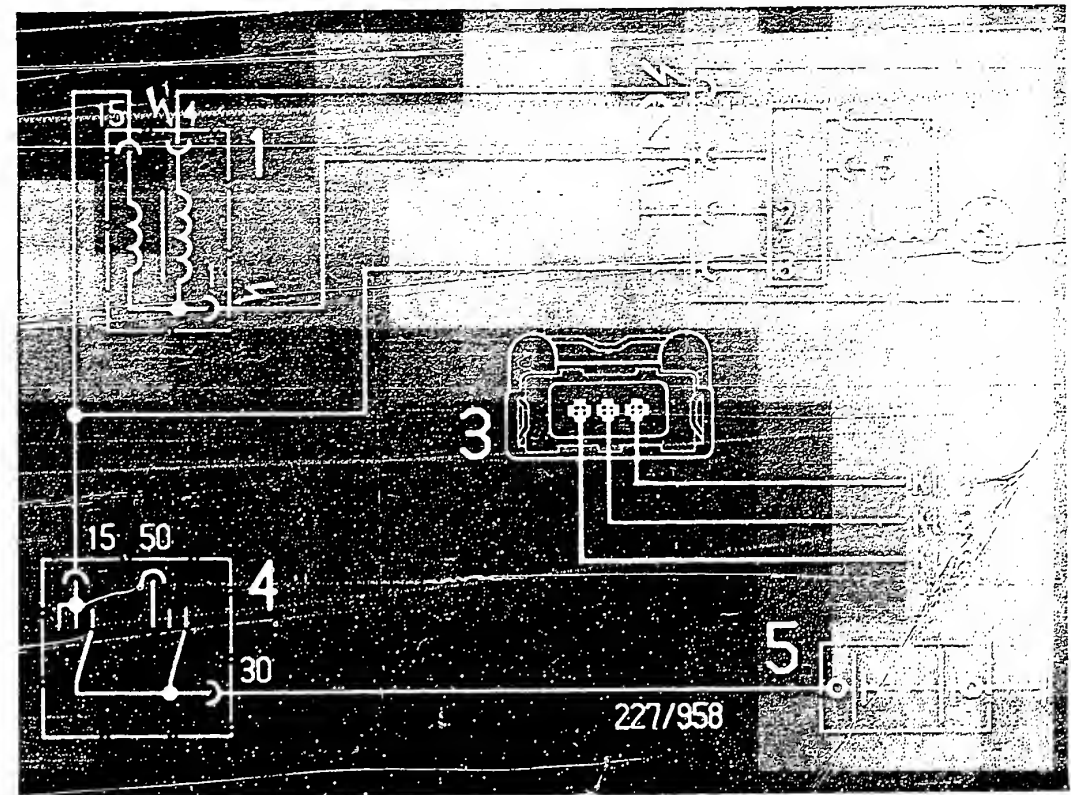
Primary voltage  
 at engine idle 290...400 V

Magnetic pulse generator

Insulation infinite  $\Omega$

Internal resistance 265...465 k  $\Omega$

See Autodata test specifications for settings  
 for ignition, idle speed, CO concentration etc.



High-voltage symbols = Dangerous voltages  
 (400 V...25 kV)

1 = Ignition coil

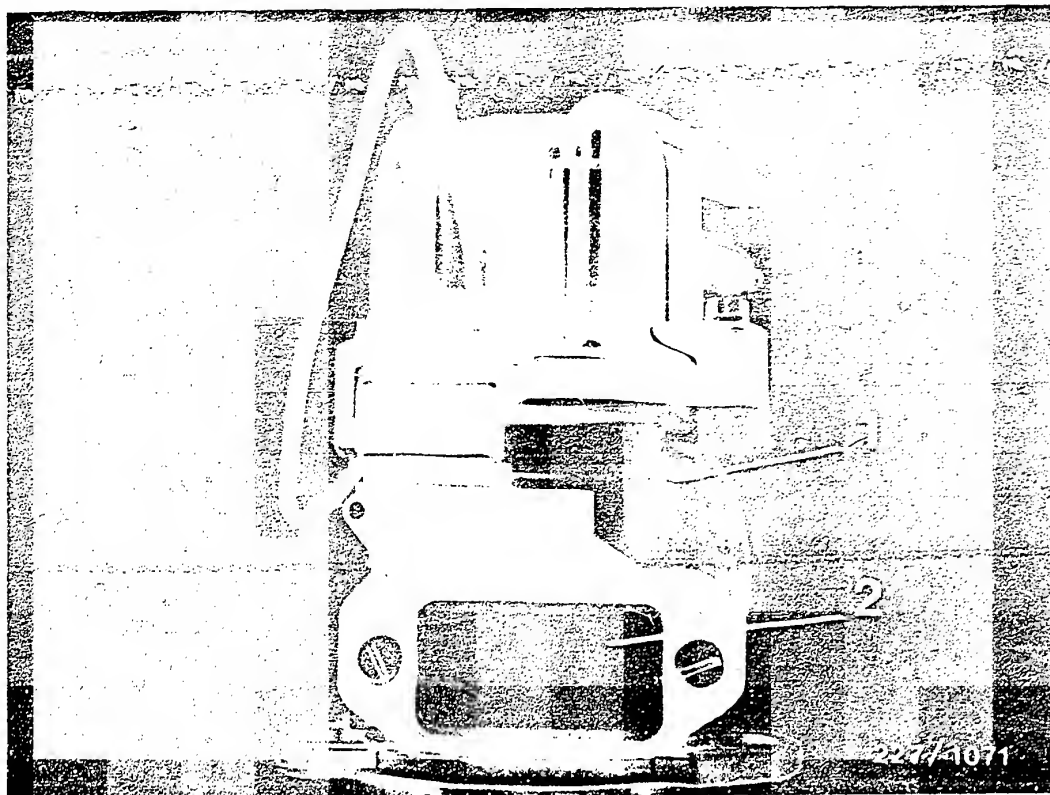
2 = Ignition distributor with trigger box

3 = Trigger-box plug

4 = Ignition and starting switch

5 = Battery

ELECTRICAL TERMINAL DIAGRAM



1 = Ignition distributor

2 = TI-I trigger box

#### Installation position of components

The TI-I trigger box is bolted on to the ignition distributor.

#### Note on removal:

Loosen ignition-distributor mounting.

Loosen two screws and remove trigger box.

After installing the trigger box, set the ignition point; see Autodata test specifications.



#### INSTALLATION POSITION OF COMPONENTS (Continued)

The ignition coil is bolted on to the cylinder head.

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|-------------------------------|----------------------------|
| Trouble-shooting instructions | : ALF-5006                 |
| BOSCH system                  | : Air-conditioning control |
| Make of vehicle               | : Alfa Typ 164             |
| Basic microcard               | : SAA-502                  |

| Section                                  | Coordinate |
|--|------------|
| Special features, safety, usage.....     | 03         |
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| Self-diagnosis.....                      | 09         |
| Test specifications.....                 | 13         |
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| Installation position of components..... | 19         |

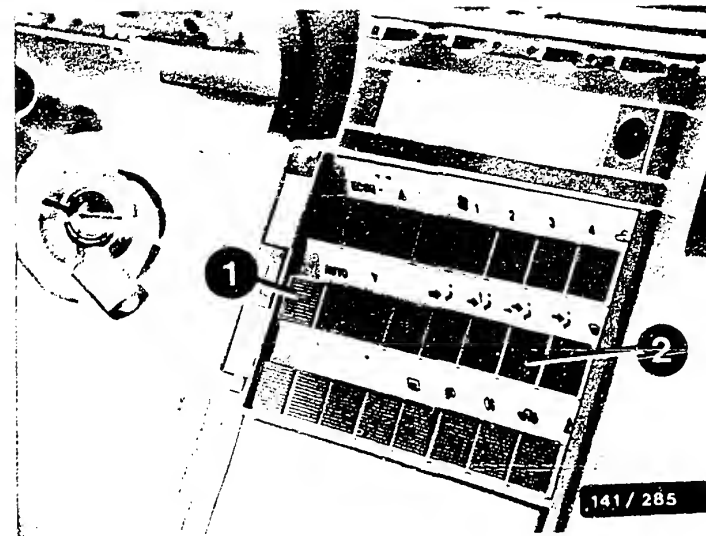
For production reasons:  
continued on the following  
coordinate.



## SPECIAL FEATURES

- \* This microcard contains the trouble-shooting instructions, valid at the time of publication, for the air conditioner in the following Alfa models:  
Typ 164 (10.87 ->)
- \* The heater unit of the air conditioner is controlled at the air-discharge side.
- \* The mixing flap and air-distribution flap are positioned by stepping motors. The positioning steps and thus the position of the mixing and air-distribution flaps are stored in the control unit. When the ignition is switched on, the stepping motors first of all move to their stop (adjusting movement), and are then positioned by the control unit to the corresponding position for the preselected temperature. The operating mode set before switching off the ignition is stored for as long as the voltage supply (term. 30) remains connected. The system always starts in the operating mode stored, as long as the system must not heat or cool to its full capacity depending upon the outside and passenger-compartment temperature.
- \* The control unit is equipped with a self-diagnosis facility. If a fault should occur in the system, this is stored in the fault memory. If a sensor breaks down, the control unit operates using specified substitute values.

The self-diagnosis is activated by simultaneously pressing the AUTO (1) and VENT (2) push-buttons on the operating element and releasing the AUTO push-button first.  
The self-diagnosis is read off via the temperature-set-value indicator in the operating element.



1 = AUTO push-button  
2 = VENT push-button

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

**ATTENTION:** Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

### CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For production reasons:  
continued on the following  
coordinate.

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. No or poor heating effect
2. No or poor cooling effect
3. Heating blower cannot be regulated
4. Incorrect air distribution
5. Circulatory operation not possible in AUTO mode
6. Heated rear window not operating
7. Temperature set value and operating mode are not stored when ignition OFF
8. AUTO mode not possible
9. Activation unit of trunk-lid opener not operating.
10. Hazard-warning and turn-signal system, fog lamps, and fog-warning lamps cannot be switched
11. Clock or lighting operating element defective.

Cause (component fault)

|   |   |   |   |   |   |   |   |   |   |   |                                 |
|---|---|---|---|---|---|---|---|---|---|---|---------------------------------|
| * | * | * | * | * | * | * | * | * | * | * | Evaluate self-diagnosis         |
| * |   |   |   |   |   |   |   |   |   |   | Coolant level too low           |
| * |   |   |   |   |   |   |   |   |   |   | Test refrigerant level          |
| * |   |   |   |   |   |   |   |   |   |   | Anti-icing device defective     |
| * |   |   |   |   |   |   |   |   |   |   | Drier defective                 |
| * |   |   |   | * |   |   |   |   |   |   | Compressor activation defective |
| * |   |   |   | * |   |   |   |   |   |   | Pressure switch defective       |
| * |   |   |   |   |   |   |   |   |   |   | Capacitor dirty                 |
| * | * |   |   |   |   |   |   |   |   |   | Test blower regulator           |

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. No or poor heating effect
2. No or poor cooling effect
3. Heating blower cannot be regulated
4. Incorrect air distribution
5. Circulatory operation not possible in AUTO mode
6. Heated rear window not operating
7. Temperature set value and operating mode are not stored when ignition OFF
8. AUTO mode not possible
9. Activation unit of trunk-lid opener not operating.
10. Hazard-warning and turn-signal system, fog lamps, and fog-warning lamps cannot be switched
11. Clock or lighting operating element defective.

Cause (component fault)

|   |   |   |   |   |   |  |   |  |  |  |   |
|---|---|---|---|---|---|--|---|--|--|--|---|
| * | * |   | * |   |   |  |   |  |  |  | Stepping motor mechanically defective           |
| * | * |   | * |   |   |  |   |  |  |  | Adjusting flaps defective                       |
| * |   | * |   |   |   |  |   |  |  |  | Blower motor defective                          |
|   |   |   | * |   |   |  |   |  |  |  | Motor, fresh-air/circulating-air flap defective |
|   |   |   |   | * |   |  |   |  |  |  | Test rear window heater                         |
|   |   |   |   |   |   |  | * |  |  |  | Test fog lamps/fog warning lamp                 |
|   |   |   |   |   |   |  | * |  |  |  | Test trunk-lid opener                           |
| * |   |   |   |   |   |  |   |  |  |  | Test sensor blower                              |
|   |   |   |   |   |   |  | * |  |  |  | Test hazard-warning and turn-signal system      |
|   |   |   | * | * | * |  | * |  |  |  | Control defective                               |
|   |   |   |   |   |   |  | * |  |  |  | Repair lighting                                 |

# SELF-DIAGNOSIS TEST TABLE

| Fault indication<br>Flashing code | Testing of component/function                            | Test instructions/Test conditions   | Terminals                       | Set values   |
|-----------------------------------|--|---|---------------------------------|--|
| 1U                                | Passenger-compartment temperature sensor (open circuit)  | Open circuit or short circuit in the sensor lead. At 15°C<br>At 30°C<br>Passenger-compartment temperature sensor defective.       | 3 12<br>3 12                    | Approx. 15,5...16,5 k Ω<br>Approx. 7,8...8,3 k Ω                                     |
| 1C                                | Passenger-compartment temperature sensor (short circuit) |   |                                 |  |
| 2U                                | Ambient-temperature (outside) sensor (open circuit)      | Open circuit or short circuit in the sensor lead. At 15°C<br>At 30°C<br>Ambient-temperature (outside) sensor defective.           | 21 12<br>21 12                  | Approx. 910...930 Ω<br>Approx. 0,99...1,01 k Ω                                       |
| 2C                                | Ambient-temperature (outside) sensor (short circuit)     |   |                                 |  |
| 3U                                | Discharge-temperature sensor (open circuit)              | Open circuit or short circuit in the sensor lead. At 20°C<br>At 40°C<br>Discharge-temperature sensor defective.                   | 4 12<br>4 12                    | Approx. 12,1...12,5 k Ω<br>Approx. 5,2...5,5 k Ω                                     |
| 3C                                | Discharge-temperature sensor (short circuit)             |   |                                 |  |
| 5U                                | Mixing-flap motor (stepping motor)                       | Open circuit or short circuit in the leads to the mixing-flap motor.  | 6 19<br>7 19<br>8 19<br>9 19    | Approx. 70...100 Ω<br>Approx. 70...100 Ω<br>Approx. 70...100 Ω<br>Approx. 70...100 Ω |
| 5C                                |  | Inter-phase or interwinding short circuit in mixing-flap motor or in the leads to the mixing-flap motor.                          |                                 |  |
| 6U                                | Air-distribution-flap motor (stepping motor)             | Open circuit or short circuit in the leads to the air-distribution-flap motor.  | 5 19<br>22 19<br>24 19<br>30 19 | Approx. 70...100 Ω<br>Approx. 70...100 Ω<br>Approx. 70...100 Ω<br>Approx. 70...100 Ω |
| 6C                                |  | Inter-phase or interwinding short circuit in the air-distribution-flap motor, or in the leads to the air-distribution-flap motor. |                                 |  |

SELF-DIAGNOSIS TEST TABLE

| Fault indication<br>Flashing code | Testing of<br>component/function                 | Test instructions/Test conditions   | Termi-<br>nals | Set values   |
|-----------------------------------|--|---|----------------|--|
| 7U                                | Fresh-air-flap/<br>circulating-air-flap<br>motor | Open circuit or short circuit to ground (phase 1 or 2) in the lead to the motor of the fresh-air/circulating-air flap. Motor of fresh-air/circulating-air flap defective. | 11 10          | 35...65 Ω  |
| 7C                                |  | Short-circuit in motor or motor locked.   |                |  |
| 8U                                | Blower control and<br>blower motor               | Open circuit or short circuit in leads to the blower regulator.   |                |  |
| 8C                                |  | Connect control unit. Switch on ignition.<br>Short circuit in the control lead to the blower regulator.<br>Blower regulator defective.                                    |                |  |
|                                   |  | Blower speed 1: 27 13<br>Blower speed 2: 27 13<br>Blower speed 3: 27 13<br>Blower speed 4: 27 13  |                | Approx. 0,65...0,75 V<br>Approx. 1,05...1,15 V<br>Approx. 2,0...2,15 V<br>Approx. 3,3...5,0 V<br>(dependent upon amb. temp.) |
| EU                                | Control unit                                     | Control unit defective.   | —              | —  |

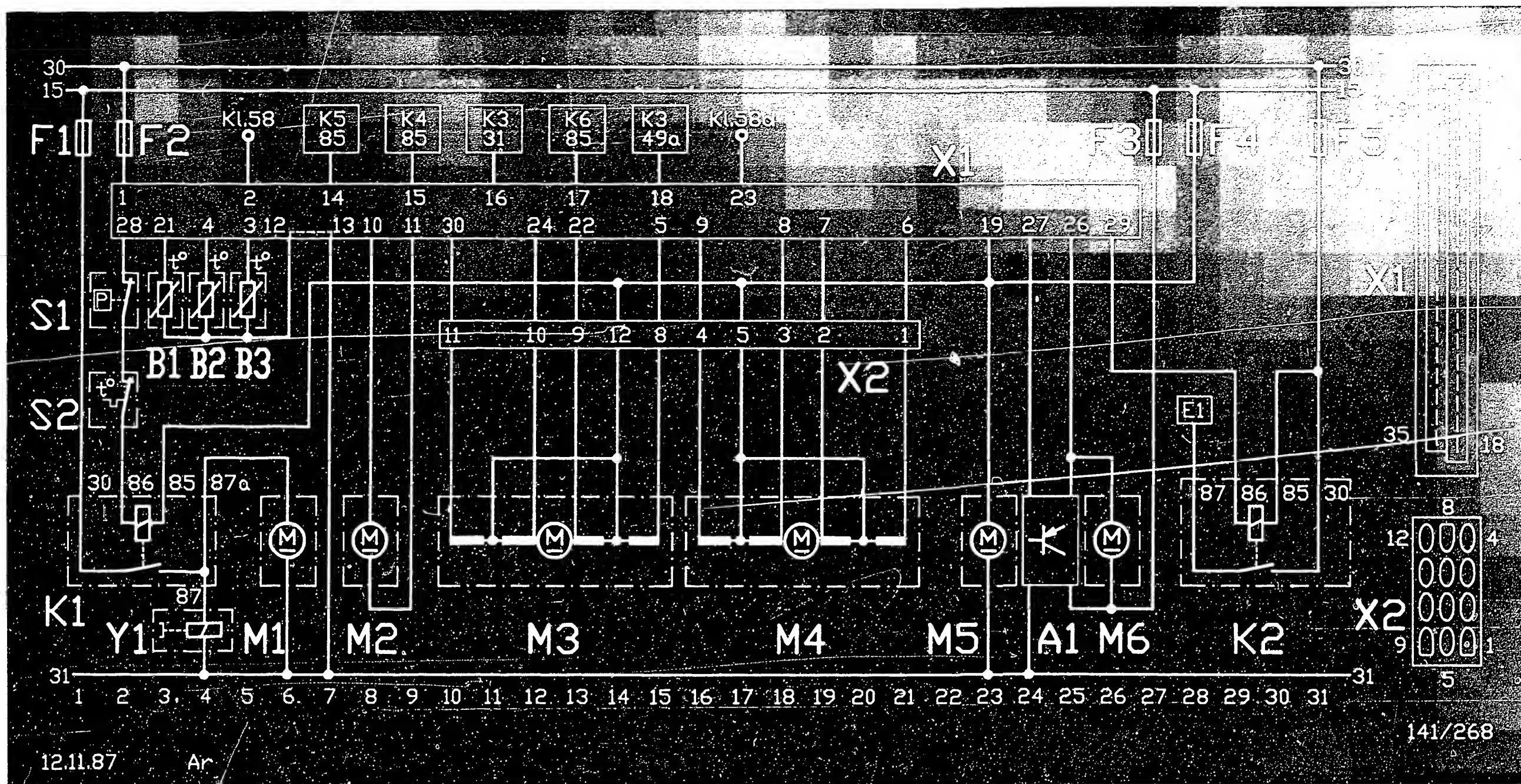
TEST SPECIFICATIONS

Internal resistance

|   |  |
|---|--|
| Passenger-compartment temperature sensor          | 16...8 k $\Omega$<br>at 15...30 °C       |
| Discharge-temperature sensor                      | 12,5...5,2 k $\Omega$<br>at 20...40 °C   |
| Ambient-temperature (outside) sensor              | 0,910...1,01 k $\Omega$<br>at 15...30 °C |
| Motor, fresh-air/circulating-air flap             |  |
| Winding resistance                                | 35...65 $\Omega$                         |
| Stepping motor, mixing and air-distribution flaps |  |
| Winding resistance                                | approx. 70...100 $\Omega$                |
| Blower regulator:                                 |  |
| Control voltage                                   | 0...5 V                                  |
| Blower-motor current                              | 0...25 A                                 |

For production reasons:  
continued on the following  
coordinate.





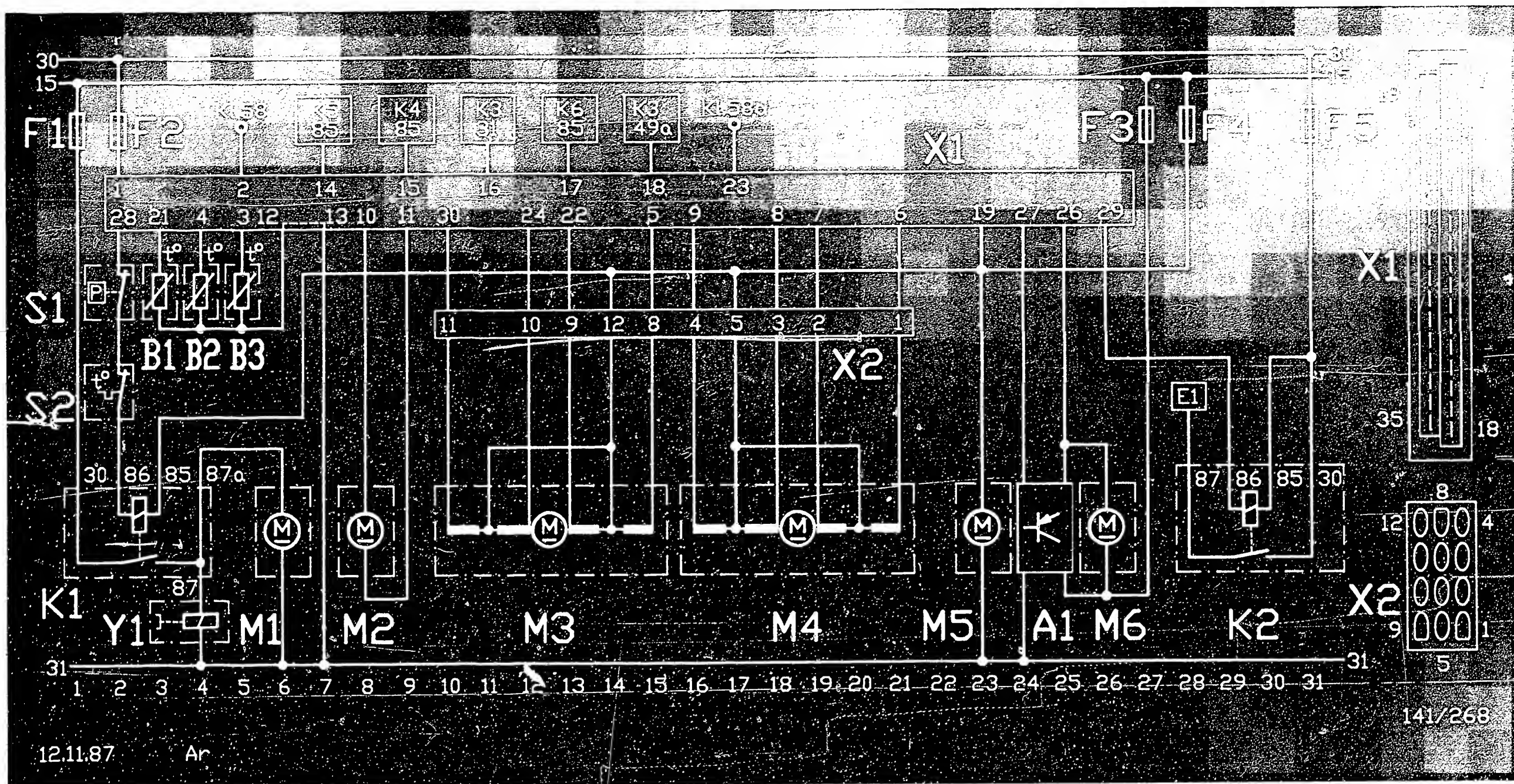
A1 = Blower regulator  
 B1 = Ambient-temperature (outside) sensor  
 B2 = Discharge-temperature sensor  
 B3 = Passenger-compartment temperature sensor  
 E1 = Rear-window heater  
 F1...F5 = Fuses, central electrics  
 K1 = Relay, refrigerant compressor

K2 = Relay, rear-window heater  
 K3 = Hazard-warning and turn-signal relay  
 K4 = Relay, fog warning lamp  
 K5 = Relay, fog lamps  
 K6 = Relay, trunk-lid opener  
 M1 = Auxiliary fan  
 M2 = Motor, fresh-air/circulating-air flap

ELECTRICAL TERMINAL DIAGRAM - AIR CONDITIONER

J15 —————>

J16 —————<==



M3 = Stepping motor, air-distribution flap  
 M4 = Stepping motor, mixing flap  
 M5 = Air-intake blower for passenger-compartment  
 temperature-sensor ventilation  
 M6 = Blower motor  
 S1 = Pressure switch

S2 = Anti-icing-device switch  
 X1 = Plug, control unit with operating element  
 (term. 12 and term. 13 connected internally in ECU)  
 X2 = Plug, flap positioner  
 Y1 = Magnetic clutch, refrigerant compressor

ELECTRICAL TERMINAL DIAGRAM - AIR CONDITIONER (CONTINUED)

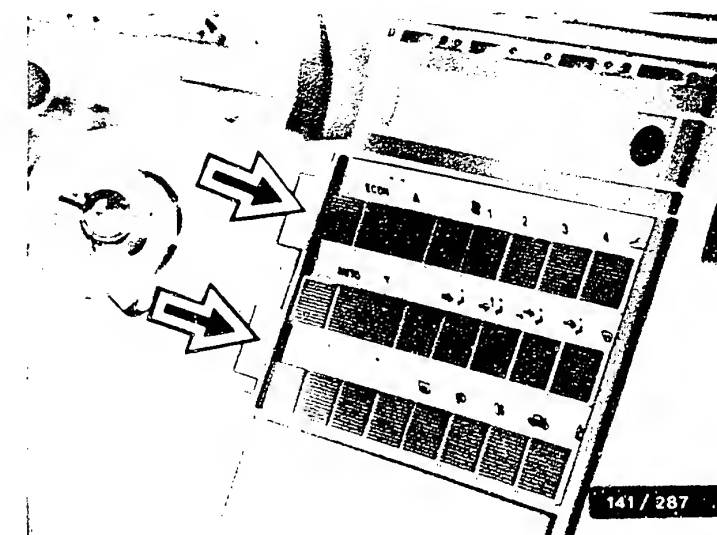
J17 ————— <==>

J18 ————— <==>

## INSTALLATION POSITION OF COMPONENTS

The operating element with integral control unit is located in the center console (upper illustration).  
To remove the element, unclip the trim on the center console (already removed in illustration).  
Then unscrew fastening screws (illustration, arrows) and remove the control unit with operating element from the center console.

Exchange the defective bulb of the operating-element lighting:  
remove the operating element with control unit.  
Unscrew the operating-element halves. Unscrew the PC board of the operating element and take out of the operating-element half.  
Pull the bulbs out of the plug-in cap and insert new bulb.  
Re-assemble operating element and control unit.

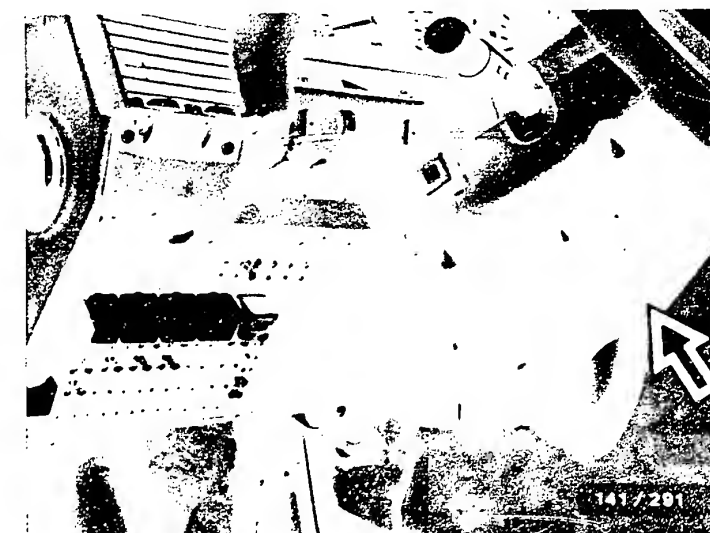




## INSTALLATION POSITION OF COMPONENTS (Continued)

The passenger-compartment temperature sensor (upper illustration, arrow) and central electrics are located in the footwell on the left-hand side.

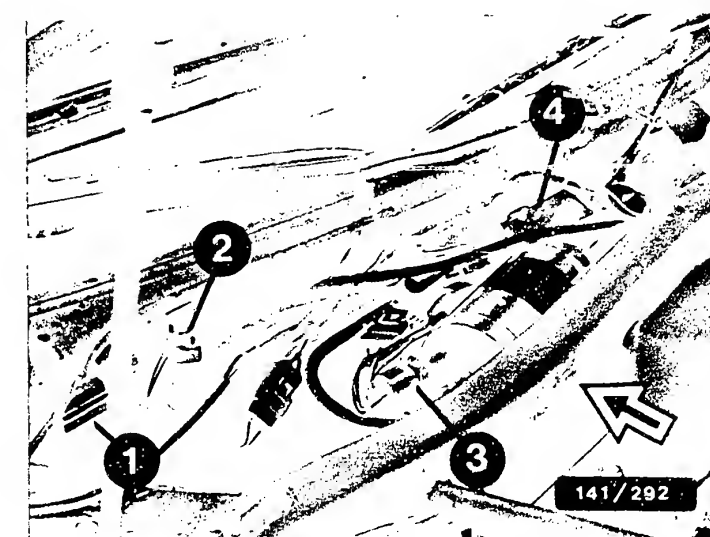
The discharge-temperature sensor (no illustration) is clipped into the air-distributor housing on the left.



The fresh-air/circulating-air flap drive (1), the ambient temperature (outside) sensor (2), the pressure switch (3), and the anti-icing-device switch (4) are located in the engine compartment.

The blower regulator with heat sink is located in the blower unit. For removing and installing the blower regulator, the partition (lower illustration, arrow) must be removed.

When installing a new blower regulator, apply thermal conduction compound 5 942 860 003 to the contact surface of the blower regulator.  
Note: thermal conduction compound is poisonous!



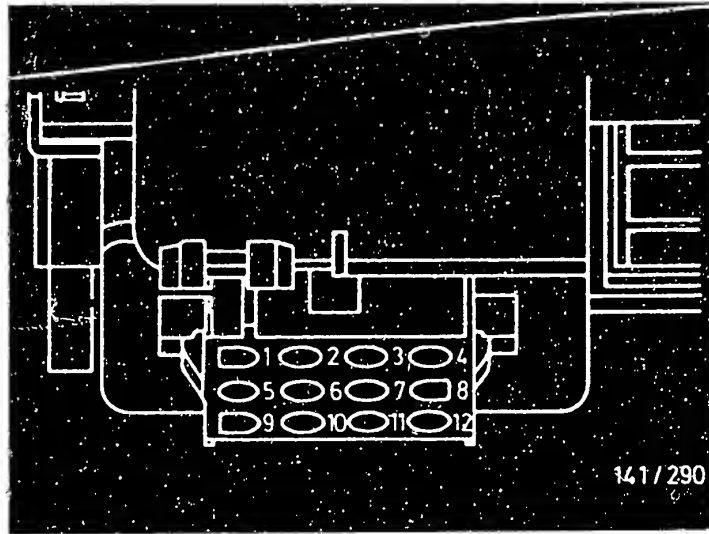
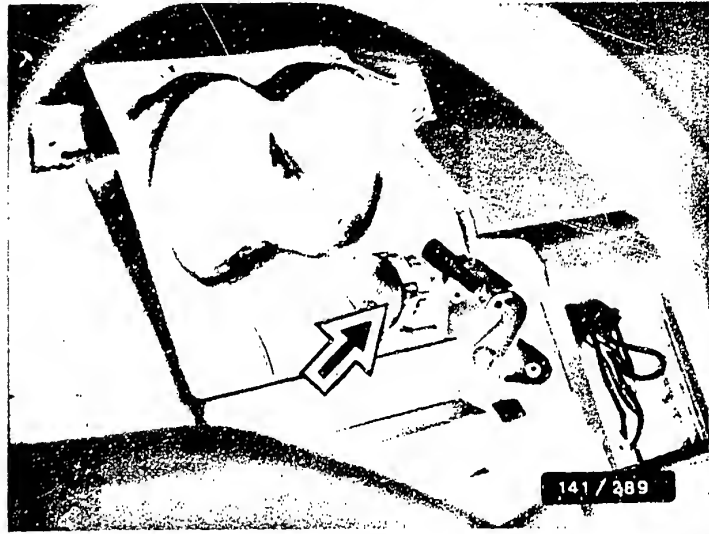
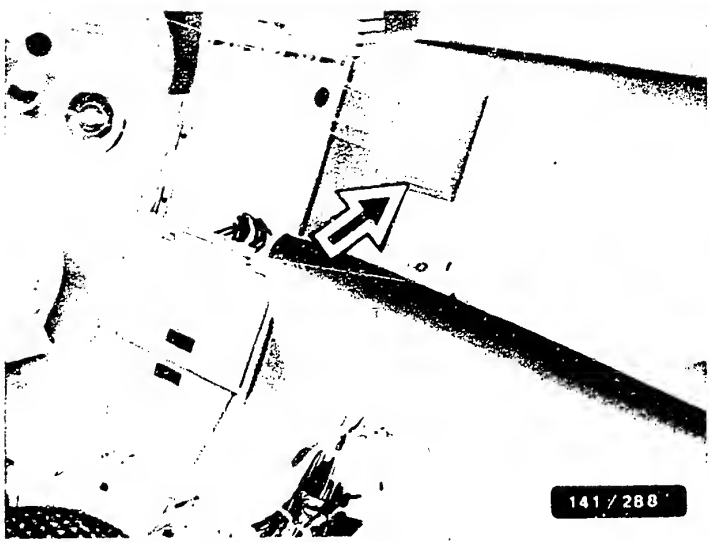
INSTALLATION POSITION OF COMPONENTS (Continued)

The flap positioner consists of the air-distribution-flap drive and the mixing-flap drive.  
Both flaps are driven via stepping motors.  
The flap positioner is mounted on the heater housing (center illustration, arrow).  
Access may be gained to the plug-in connection of the flap positioner via the cover (upper illustration, arrow).

Test the winding resistances of the stepping motors:  
(see lower illustration for plug assignment of flap positioner)

|                          |              |             |          |          |
|--------------------------|--------------|-------------|----------|----------|
| Resistance between term. | 1 and term.  | 5: approx.  | 70...100 | $\Omega$ |
| term.                    | 2 and term.  | 5: approx.  | 70...100 | $\Omega$ |
| term.                    | 3 and term.  | 5: approx.  | 70...100 | $\Omega$ |
| term.                    | 4 and term.  | 5: approx.  | 70...100 | $\Omega$ |
| term.                    | 8 and term.  | 12: approx. | 70...100 | $\Omega$ |
| term.                    | 9 and term.  | 12: approx. | 70...100 | $\Omega$ |
| term.                    | 10 and term. | 12: approx. | 70...100 | $\Omega$ |
| term.                    | 11 and term. | 12: approx. | 70...100 | $\Omega$ |

The air-intake blower for the passenger-compartment temperature-sensor ventilation is mounted on the flap positioner.



Trouble-shooting instructions : OPE-5005

BOSCH system : ABS  
Vehicle make : OPEL OMEGA  
Basic microcard : PKW - 063

TABLE OF CONTENTS

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SPECIAL FEATURES

This microcard contains the trouble-shooting instructions, valid at the time of publication, for the following models:

\* Opel Omega 1.8 , 1.8 S , 2.0 , 2.3 ,  
2.3 TD , 3.0 —> 10.86

ABS with 4 wheel-speed sensors and 3 hydraulic channels.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

For a detailed description of trouble-shooting, see the basic instructions.

ATTENTION :  
The set values, terminal assignments and special features of these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

\*For reasons of safety, the hydraulic modulator must not be repaired, but may be exchanged only as a complete unit.  
Exception: relays  
\*Do not loosen any screws on the hydraulic modulator! Danger of fatal accident owing to failure of the brakes.  
\*Take great care when handling brake fluid.  
Poison!

For further information, see brief instructions.



## TEST REQUIREMENTS FOR TESTING WITH ABS2 LED TESTER

- \* Regulatory tire size fitted?
- \* Check for firm seating of ground of return-supply pump.
- \* Check for firm seating and corrosion of ground of overvoltage-protection relay term. 31.
- \* Check for firm seating of ground strap between engine block and vehicle frame.
- \* Check for leaks in hydraulic connections at hydraulic modulator and sealing points (visual examination).
- \* If the ABS warning lamp lights up intermittently when driving (e.g. after switching on loads) and goes out again by itself, check the battery and power supply (alternator, regulator and voltage drops).
- \* If the ABS warning lamp lights up constantly and does not go out, check the following points:
  - Controller plug sitting correctly on controller and latched?
  - All plug contacts O.K.?
  - Spring contacts latched?
  - Check installation position for correct seating of seal ring in controller plug, rounded side downward.

- Check wheel-speed sensor leads at controller plug for correct assignment:

### Wheel-speed sensors:

Front left - term. 6 and term. 4.  
Front right - term. 11 and term. 21.  
Rear left - term. 8 and term. 9.  
Rear right - term. 24 and term. 26.

- V-belt torn?  
(Alternator does not supply voltage, charging and ABS warning lamp light up).
- \* Connect ABS—LED tester to ABS wiring harness.
- Only detach and connect controller with ignition off.
- For test purposes, switch on ignition in all program switch settings (tester runs on power supplied by vehicle battery).
- Observe LED (green) for power supply; in all program switch settings.

## I M P O R T A N T !

Do not drive with the tester connected!  
The entire test program is to be repeated whenever repairs have been carried out.  
The ABS system is a vehicle safety system.  
Work on this system require detailed knowledge of the system.  
The conventional brake system must be working properly.

### General trouble-shooting information:

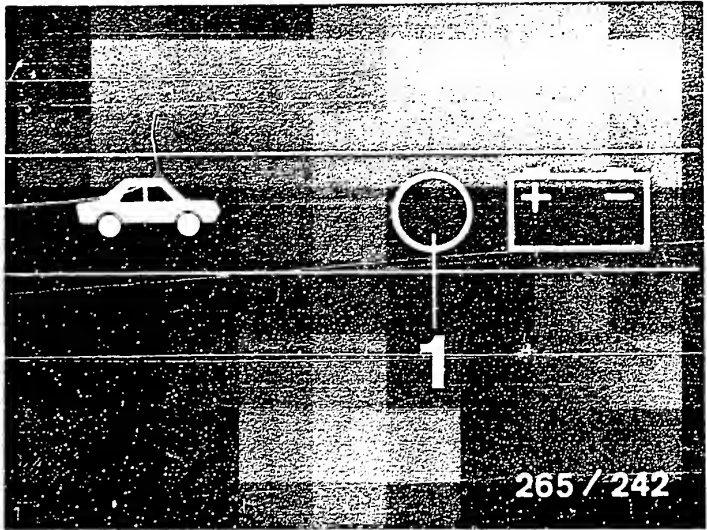
Check all leads for short-circuit to ground and contact with positive leads, as well as for rubbing and pinching.

RAPID DIAGNOSIS CHART

Do not drive with tester connected. Are all test conditions met?

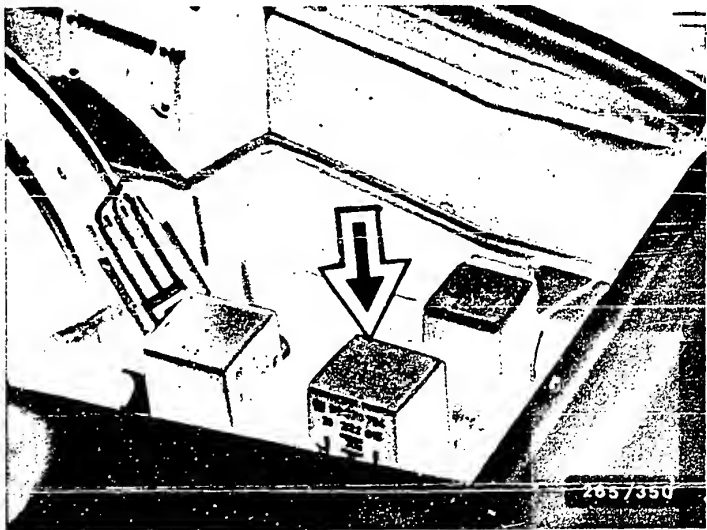
Program-switch positions 1 to 6

| Testing of<br>(measurement at<br>terminals) | Additional<br>operation | Test specifi-<br>cation (reading)             | Possible causes of faults   |
|---|-------------------------|---|---|
| Power supply<br><br>(term.1 und<br>term.-)  | Ignition on             | LED 1<br>(top picture)<br>continuously<br>lit | <ul style="list-style-type: none"><li>*Battery insufficiently charged</li><li>*High voltage drops</li><li>*Overvoltage-protection relay<br/>defective</li><li>*Check lead to driving switch<br/>term.15</li></ul> |



1 = LED for supply voltage

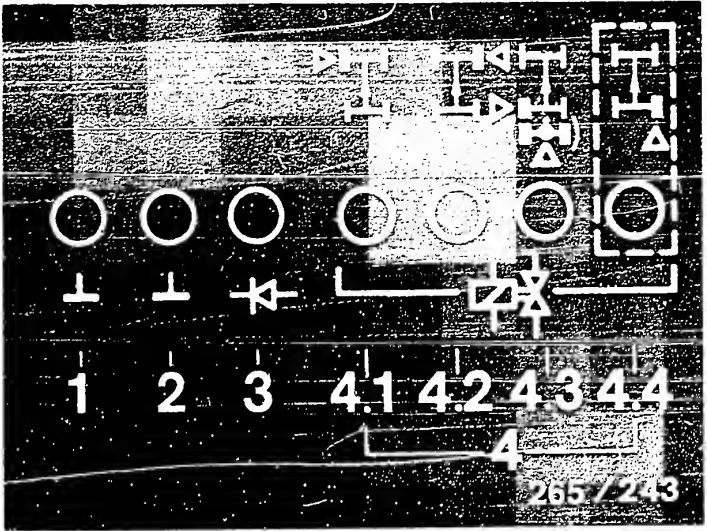
Arrow = Overvoltage-protection rel



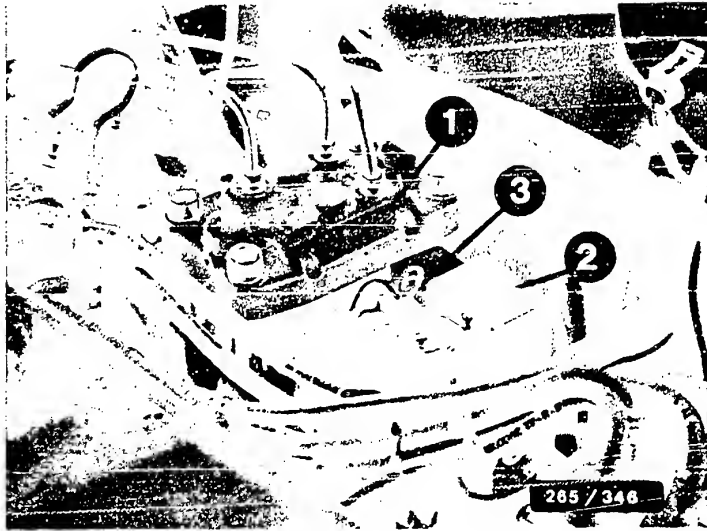
Rapid diagnosis chart (Continued 1)

Program-selector-switch position 1 (3-duct hydraulic modulator)

| Test on<br>(measurement at<br>terminals)   | Addit-<br>ional<br>operation | Test<br>specification<br>(reading)  | Possible causes of trouble<br>(see coordinate)   |
|--|------------------------------|---|--|
| Ground<br>(term.10, term.34)<br><br>Diode for warning<br>lamp<br>(term.29, term.32)<br><br>Solenoid-operated<br>valve internal<br>resistances<br>(term.2, term.18,<br>term.-, term.35)<br>Off-position and<br>ground of valve<br>relay<br><br>ABS warning lamp | Ignition<br>on               | 6 LEDs<br>(1 to 4.3)<br><br>light up equal-<br>ly brightly<br>(upper ill.)<br><br>ABS warning<br>lamp in vehicle<br>must light up | <ul style="list-style-type: none"><li>* LED 1 and / or 2 (upper<br/>illustration) do not light up:<br/><br/>Check ground terminals for short<br/>circuit.<br/>(-)</li><li>* LED 3 (upper illustration) does not<br/>light up: diode defective, check<br/>ground of valve relay.<br/><br/>(-)</li><li>* One or more LED 4 do not light up:<br/>Check corresponding plug<br/>connection for solenoid-operated<br/>valve and leads.<br/>(-)</li></ul> <p>Solenoid-operated valve, internal<br/>resistance 0,7...1,7 <math>\Omega</math></p> <ul style="list-style-type: none"><li>* All LED 4 and LED 3 do not light<br/>up:<br/><br/>Check ground of valve relay, valve<br/>relay defective.<br/>(-)</li><li>* Weak lighting of a LED means<br/>contact resistance in corresponding<br/>current path.<br/>(-)</li><li>* ABS warning lamp does not light up:<br/>warning lamp defective.<br/>Note: all other 6 LEDs light up<br/><br/>(-)</li></ul> |



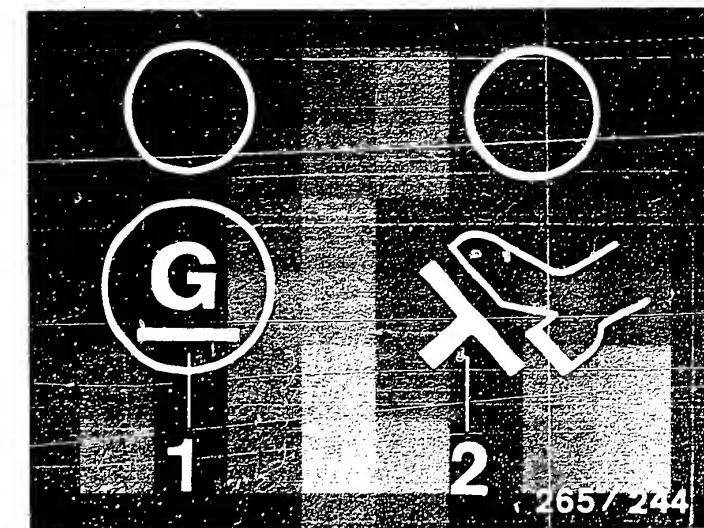
1 = Hydraulic modulator  
2 = Motor relay  
3 = Valve relay



# RAPID DIAGNOSIS CHART (CONTINUATION 2)

Program-selector-switch position 2

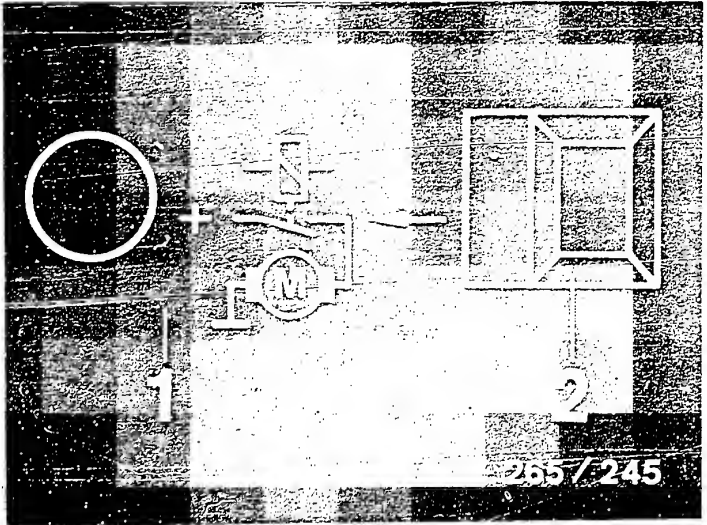
| Test on<br>(Measurement at<br>terminals)      | Additional<br>operation   | Test<br>specification<br>(reading)                                  | Possible causes of trouble<br>(see coordinate)   |
|---|---------------------------|---|--|
| Generator voltage<br>of term. 61<br>term. 15) | Ignition<br>on            | LED 1<br>(upper<br>illustration)<br>lights up.                      | * LED sometimes goes out only after<br>snap acceleration (test is then<br>O.K.)<br>(-) |
|   | Start<br>engine           | LED 1<br>(upper<br>illustration)<br>goes out with<br>engine running | * Check lead to generator term. 61<br><br>* Generator defective.                       |
| Stop-lamp switch<br>(term. 25)                | Ignition<br>on            | LED 2<br>(upper<br>illustration)<br>lights up                       | * Stop-lamp switch defective.<br>(-)<br><br>* Check lead to stop-lamp switch.          |
|   | Actuate<br>brake<br>pedal | LED 2<br>(upper<br>illustration)<br>goes out                        | * Lead at stop-lamp switch incorrectly<br>connected.                                   |



Rapid diagnosis chart (Continued 3)

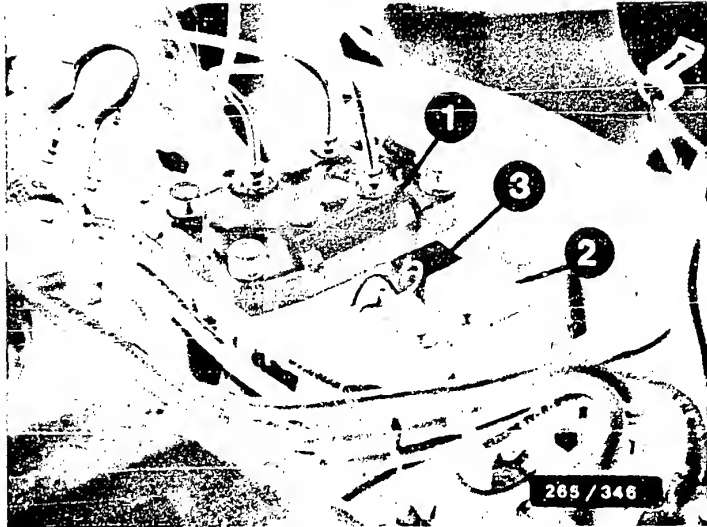
Program-selector-switch position 3

| Test on<br>(measurement<br>at terminals)  | Additional<br>operation  | Test<br>specifications<br>(reading)  | Possible causes of trouble<br>(see coordinate)   |
|---|--|--|--|
| Motor relay,<br>pump motor in<br>hydraulic<br>modulator<br>(term.28 and<br>term.14) | Ignition on,<br>constantly<br>press push-<br>button 2<br>(upper ill-<br>ustration) | LED 1 lights up,<br>pump motor runs.<br><br>After releasing<br>push-button,<br>LED stays lit<br>due to run-on of<br>motor (upper<br>illustration). | <ul style="list-style-type: none"><li>* Motor relay defective<br/>(-)</li><li>* Check ground and positive terminal<br/>of hydraulic modulator<br/>(-)</li><li>* Check leads from controller<br/>term.14 and term.28<br/>to hydraulic modulator term.9<br/>or term.11.<br/>(-)</li><li>* Pump motor defective<br/>(-)</li></ul> |



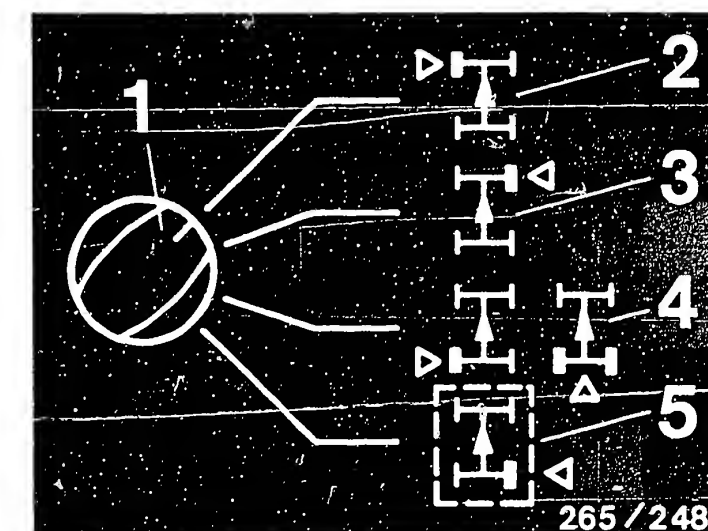
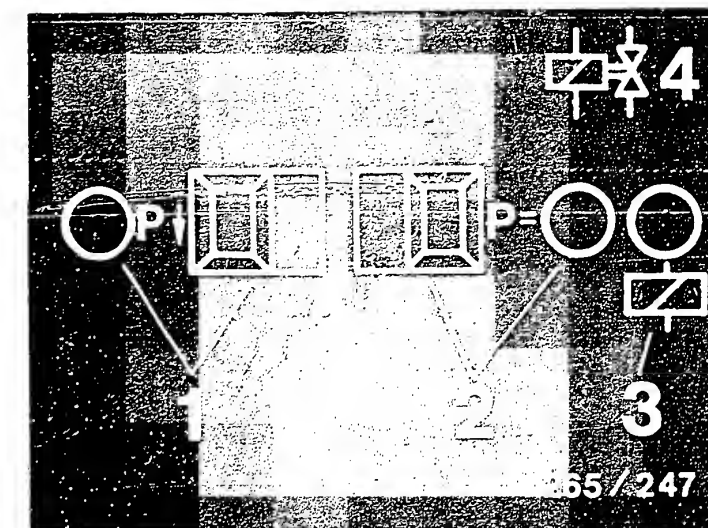
Program-selector-switch position 4 not applicable

- 1 = Hydraulic modulator
- 2 = Motor relay
- 3 = Valve relay



RAPID DIAGNOSIS CHART (CONTINUED 4)  
 Program-selector-switch position 5 (3-channel hydraulic modulator)

| Test on<br>(measurement at<br>terminals)   | Additional<br>operation   | Test<br>specification<br>(reading)                                     | Possible causes of trouble<br>(see coordinate)  |
|--|---|--|---|
| Valve relay op.<br>(term.27)   | Ignition on   | LED 3 (upper<br>illustration)<br>lights up                             | *Valve relay (winding) or<br>leads defective (-)  |
| Solenoid-operated<br>valves in<br>hydraulic<br>mod. for function<br>and mix-up.<br>NOTE:<br>Check each wheel<br>separately in<br>turn.<br>Keep to operating<br>sequence! | Chock up<br>vehicle.<br>Ignition on.<br>The wheel being<br>tested must be<br>freely turnable<br>by hand. Set<br>switch 1 for wheel<br>selection to wheel<br>to be tested.<br>(Lower ill.) |  | * Repeat test with engine<br>running<br>* Valve relay (make contact)<br>defective<br>(-)<br>* Brake in line from valve<br>relay term.87 to B+<br>(-)<br>* Brake leads at hydraulic<br>modulator mixed up<br>(-)                                     |
| Operation<br>pressure holding  | 1. Constantly<br>press push-btn<br>P= (upper ill.)  | LED P=<br>(upper ill.)<br>lights up                                    | * Current value not obtained<br>(LED P arrow or P= goes out;<br>upper illustration):<br>Battery insufficiently<br>charged. Repeat test with<br>engine running.<br><br>(-)   |
|  | 2. Constantly<br>press brake<br>pedal   | Wheel turnable<br>by hand  |   |
|  | 3. Release push-<br>button P=<br>(upper ill.)   | LED P= goes out<br>(upper ill.)<br>Wheel locks                         |   |
| Operation<br>pressure reduction  | 4. Press push-<br>button P<br>arrow (upper<br>illustration)   | LED P arrow<br>(upper ill.)<br>lights up,<br>wheel turnable<br>by hand | * Solenoid-op. valves correct-<br>ly connected electrically?<br>Wheel, front left:term.2<br>Wheel, front right:term.35<br>Wheel, rear left:term.-<br>Wheel, rear right:term.-<br>Rear axle:term.18<br>(-)<br>* Hydraulic modulator<br>defective (-) |
|  | 5.Release push-<br>button P arrow<br>(upper ill.)   | LED P arrow<br>(upper ill.)<br>goes out, wheel<br>locks                |   |
|  | 6.Release brake<br>pedal  |  |   |



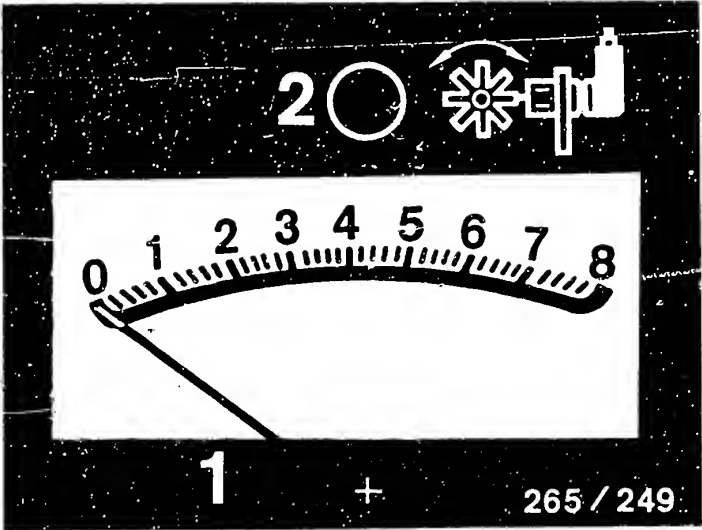
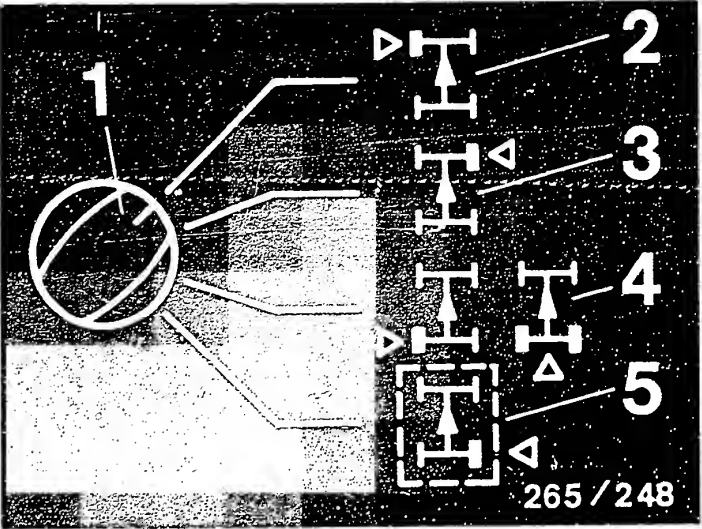


RAPID DIAGNOSIS CHART (continued 5)

Program switch setting 6 (4 Engine-speed sensor)

| Testing of<br>(measurement at<br>terminals)   | Additional<br>operation   | Test<br>specification<br>(reading)   | Possible causes of fault<br>(see coordinate)  |
|---|---|--|---|
| <p>Engine-speed sensor<br/>for proper func-<br/>tioning and mix-up</p> <p>NOTE:<br/>Perform test<br/>consecutively for<br/>each individual<br/>wheel.</p> <p>Wheel, front left:<br/>term.6 and<br/>term.0,6...1,6<br/>Wheel, front right:<br/>term.11 and<br/>term.21<br/>Wheel, rear left:<br/>term.8 and<br/>term.-<br/>Wheel, rear right:<br/>term.24 and<br/>term.-</p> | <p>Jack up vehicle.<br/>Ignition on.</p> <p>It must be possible to<br/>turn the wheel to be<br/>tested freely by hand</p> <p>The wheel not tested<br/>must be held when<br/>testing the driven<br/>axle.</p> <p>Set switch for wheel<br/>selection to wheel to<br/>be tested (bottom<br/>picture)</p> <p>Turn wheel by hand<br/>until LED 2 above<br/>instrument lights up<br/>without flickering.<br/>(Speed approx. 1 rev-<br/>olution per second).<br/>Then take instrument<br/>reading:<br/>(Top picture)</p> | <p>1.Smallest<br/>reading greater<br/>than 1,6<br/>scale divisions</p> <p>2.Permissible<br/>fluctuation<br/>band<br/>max. 25 %<br/>of maximum<br/>value.</p> | <p>*Engine-speed sensor lead<br/>interchanged<br/>(-)</p> <p>*Open circuit in engine-<br/>speed sensor lead<br/>(-)</p> <p>*Eng.-sp. sensor defect.<br/>(-)</p> <p>Winding resistance<br/>front axle:<br/>0,6...1,6 k <math>\Omega</math><br/>rear axle:<br/>4 k <math>\Omega</math></p> <p>*Air gap between engine-<br/>speed sensor and<br/>ring gear too large<br/>(9)</p> <p>*Ring gear defective or<br/>loose<br/>(26)</p> <p>*Ring gear fitted with<br/>incorrect no. of teeth<br/>Front axle: 48 teeth<br/>Rear axle: 48 teeth<br/>(-)</p> <p>*Excessive wheel bearing<br/>clearance</p> <p>*Reading given, LED 2<br/>does not light up:<br/>loose contact in engine-<br/>speed sensor lead.</p> |

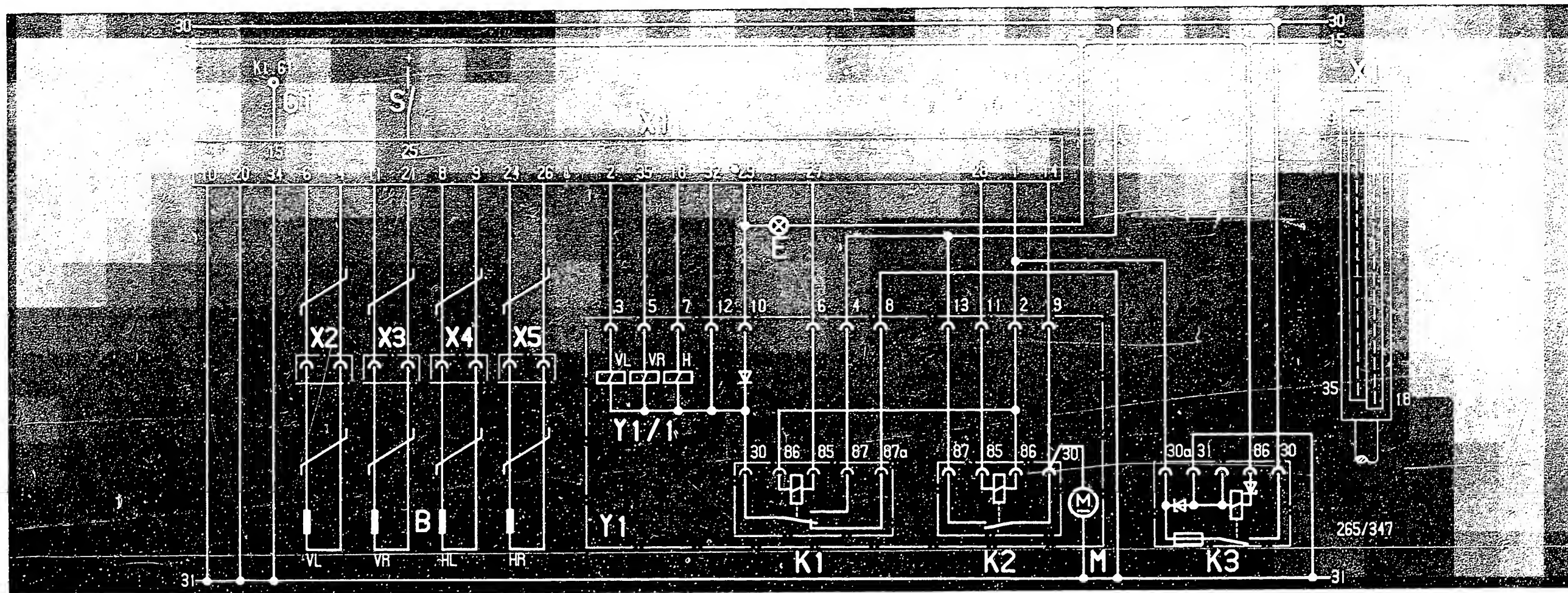
Continue test on the next coordinate.



TEST SPECIFICATIONS

|  |              |              |
|--|--------------|--------------|
| Wheel-speed sensor   |              |              |
| * Winding resistance at ambient temperature (-10°C...+120°C) for front axle: | 600...1600   | Ω            |
| rear axle:   | 600...1600   | Ω            |
| Hydraulic-modulator solenoid-operated valves                                 |              |              |
| * Winding resistance at ambient temperature (-10°C...+120°C):                | 0,7...1,7    | Ω            |
| Air gap: wheel-speed sensors, front  |              |              |
| wheel-speed sensors, rear  | 0,2...1,2 mm | 0,5...1,5 mm |
| Tightening torque for  |              |              |
| * Fastening screws of the wheel-speed sensors:                               | > 8          | Nm           |
| * Brake-line connections on the hydraulic modulator:                         | 12...16      | Nm           |
| Number of teeth  |              |              |
| * Front axle:  | 48           | teeth        |
| * Rear axle:   | 48           | teeth        |

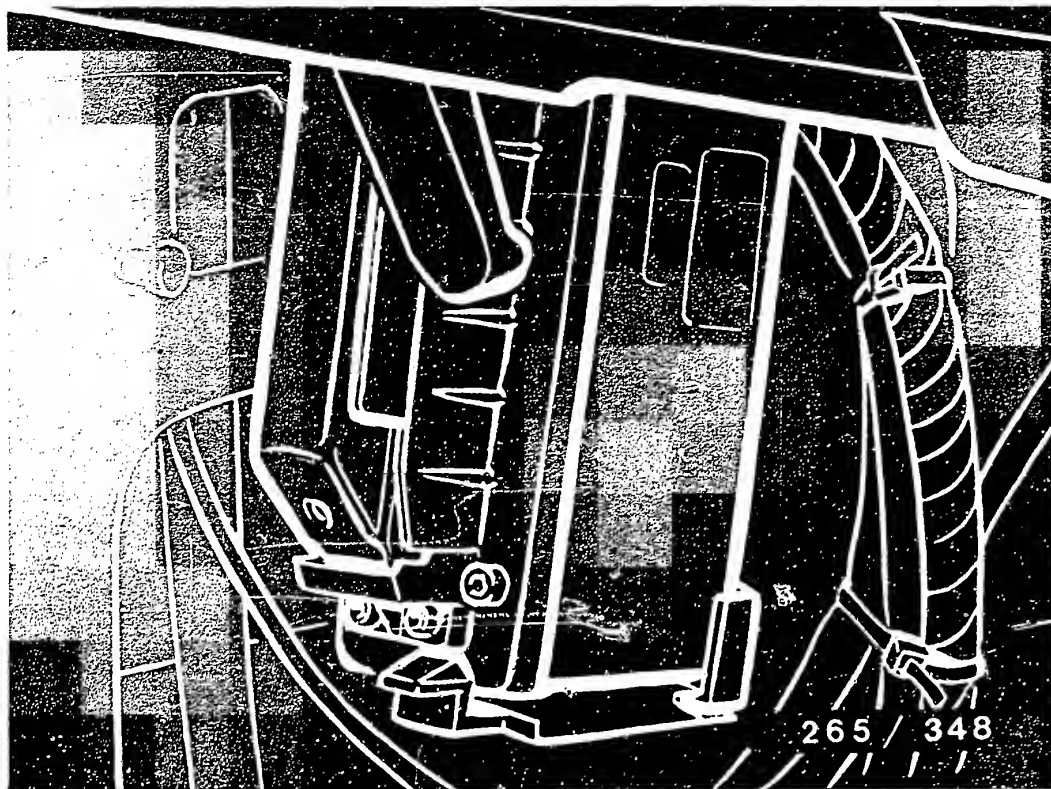
For production reasons:  
continued on the following  
coordinate.



# ELECTRICAL TERMINAL DIAGRAM

X1 = Controller plug (35-pin)  
 X2-X5 = Wheel-speed-sensor plug-in connections  
 Y1 = Hydraulic modulator  
 Y1/1 = Solenoid-operated valves  
 K1 = Valve relay  
 K2 = Motor relay  
 K3 = Overvoltage-protection relay  
 M = Return-flow-pump motor

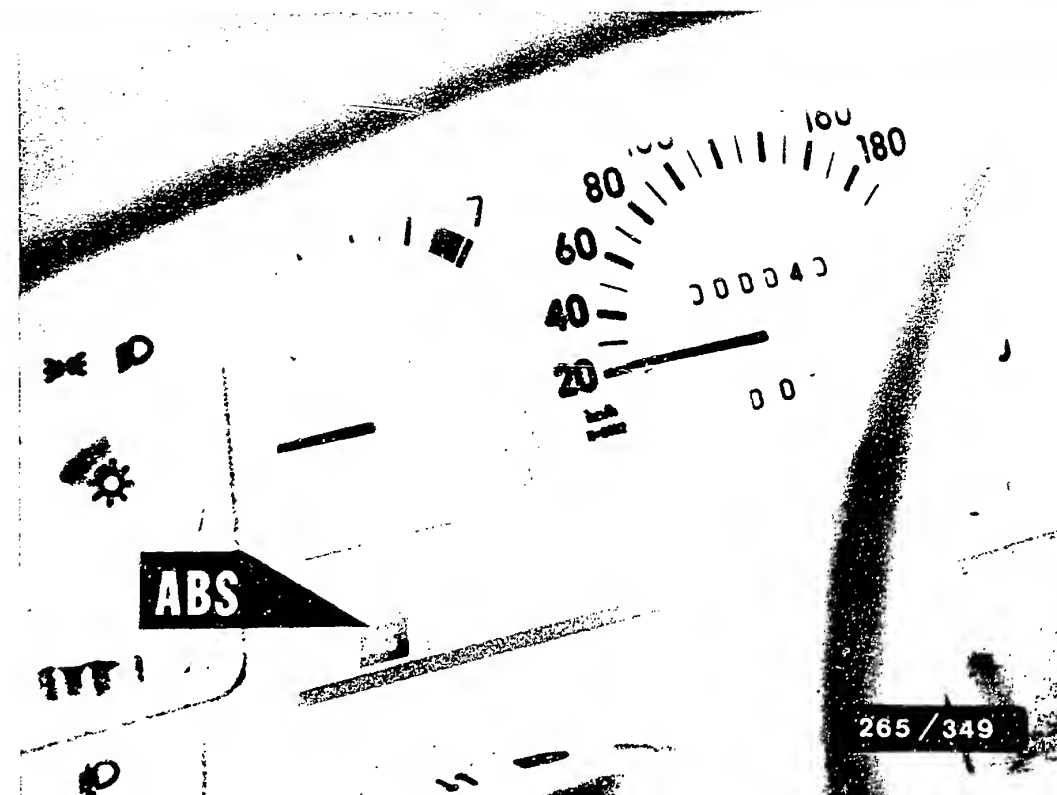
E = ABS warning lamp  
 S = Stop-lamp switch  
 G1 = To alternator term.61  
 VL = Front left  
 VR = Front right  
 HL = Rear left  
 HR = Rear right  
 H = Rear axle



#### INSTALLATION POSITION OF COMPONENTS

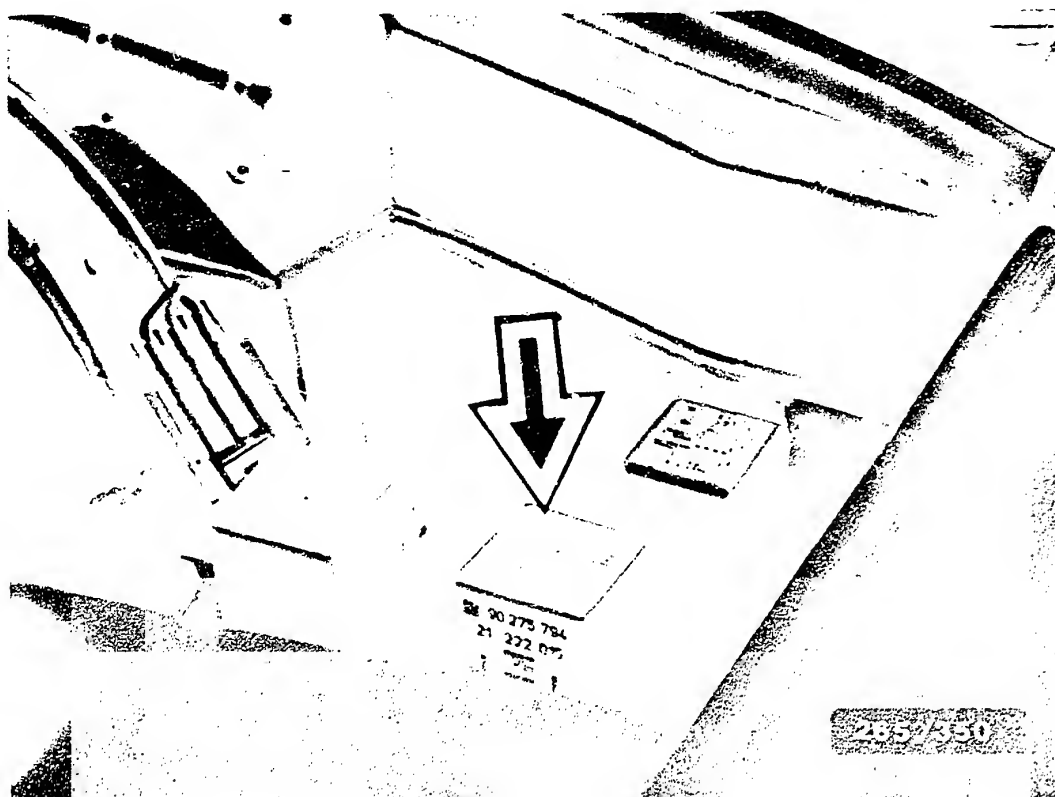
The indications "right" and "left" always refer to the forward direction of travel.

- \* Controller:  
In the footwell on the driver's side on the left-hand outer side.



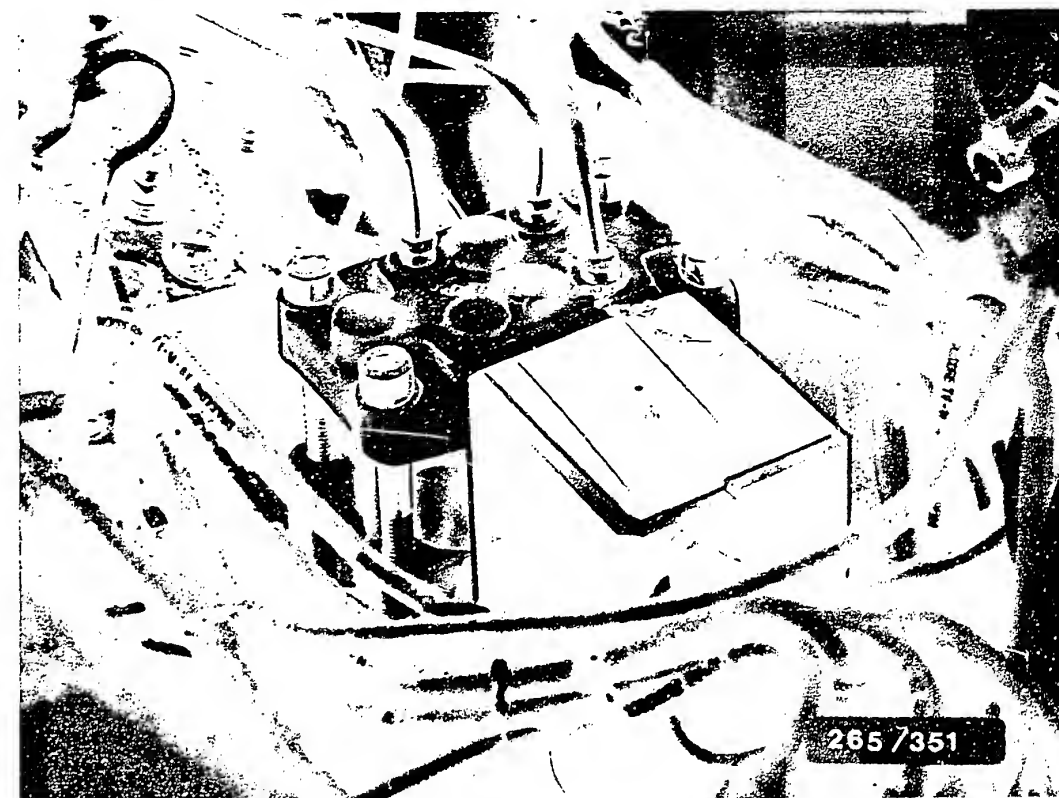
#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- \* ABS warning lamp:  
In the instrument panel in the indicator-light strip, the 3rd indicator light from the left.



INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- \* Overvoltage-protection relay:  
In the engine compartment on the left near  
to the firewall in the relay plate (arrow).



INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- \* Hydraulic modulator:  
In the engine compartment at the front left.





#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- \* Wheel-speed sensors, front axle:  
one on each side in the steering  
knuckles.  
Wheel-speed sensors, cannot be  
adjusted.

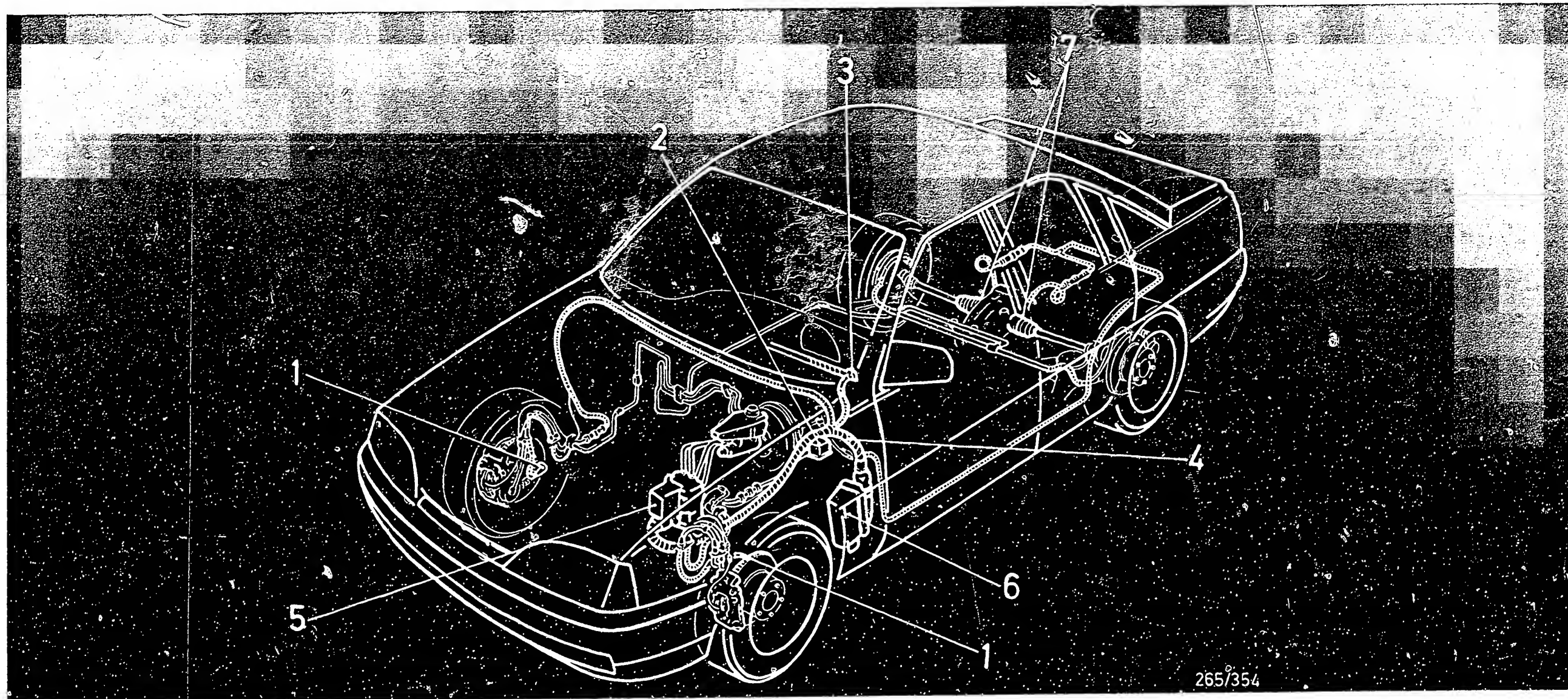


#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- \* Wheel-speed sensors, rear axle:  
one on each side of the differential.

Attention: When exchanging the wheel-speed sensors,  
pay attention to the air gap. Air gap  
can be adjusted by means of plain  
washers.





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# INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| 1 = Wheel-speed sensors, front axle | 5 = Hydraulic modulator            |
| 2 = Overvoltage-protection relay    | 6 = ABS controller                 |
| 3 = ABS - warning lamp              | 7 = Wheel-speed sensors, rear axle |
| 4 = ABS - wiring harness            |                                    |

Trouble-shooting instructions : SAA-5001  
BOSCH system : LH-Jetronic  
Make of vehicle : SAAB  
Basic microcard : SAA-504

TABLE OF CONTENTS

| Section                                  | Coordinates |
|--|-------------|
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| Installation position of components..... | 21          |

SPECIAL FEATURES

These brief instructions apply to the following vehicle models with 1.985 l/4 cyl. engine valid at the time of writing:

Saab 9000 Turbo 16V US version 05.85->  
Saab 9000 Turbo 16V US/S/D/CH version 11.85->

- \* LH2.2-Jetronic with 25-pin control unit:  
0 280 000 531, as of 11.85 0 280 000 539.
- \* Engine-speed tripping at control unit term. 1 via TD amplifier.
- \* Pump relay energization via charge-air-pressure monitor, triggered over 1.05 bar.
- \* Lambda closed-loop control with heated sensor.
- \* Mechanical throttle-valve damper.
- \* Exhaust turbo-supercharger with charge-air cooling.
- \* Knock control (APC system from the Saab company).
- \* Cutoff valve,  
compensates for high back pressure upstream of the hot-wire air-mass sensor when the accelerator pedal is released.
- \* Fuel cutoff for full-load start.
- \* No starting information via term. 4.
- \* Start control
- \* Idle-speed control with two-winding rotary adjuster.
- \* In-tank pre-supply pump and in-tank electric fuel pump
- \* For checking fuel pressure, connect pressure measuring device with connecting part KDJE-P 100/14 at pressure-regulator inlet.



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01  
 Adapter lead: 1 684 463 141

| Test step | Switch<br>V | Ω  | Termi-<br>nals | Testing of<br>component/function  | Test instructions/<br>Test conditions  | Set values                         |
|-----------|-------------|----|----------------|---|--|------------------------------------|
| 1         | <br>V       | 5  | 2 - 11         | Resistance, temperature<br>sensor (engine)  | Connect adapter lead only to periphery.<br>+15...+30°C:<br>approx. +80°C:  | 1.45...3.3 k Ω<br>280...360 Ω      |
| 2         | <br>V       | 6  | 25 - 11        | Frame connection of<br>output stage   |  | 0...10 Ω                           |
| 3         | <br>V       | 7  | 5 - 11         | Frame connection of<br>sensors  |  | 0...10 Ω                           |
| 4         | <br>V       | 8  | 13 - 11        | Resistance of the shunt-<br>connected solenoid-<br>operated injection valve<br>and lead of the sensor<br>heater | Disconnect sensor-heater plug and<br>connect short-circuit wire jumper<br>into the plug on the wiring-harness<br>side.<br>+15...+30°C:<br>approx. +80°C:               | 6,8...10,5 Ω<br>7,0...12,0 Ω       |
| 5         | <br>V       | 9  | 3 - 11         | Resistance of the<br>idle contact   | (Test of throttle-<br>valve damper) Accelerator pedal in rest position:<br>Slightly depress accelerator pedal:<br>Release accelerator pedal after<br>approx. 3...6 s : | 0...10 Ω<br>infinity Ω<br>0...10 Ω |
| 6         | <br>V       | 10 | 12 - 11        | Resistance of<br>full-load contact  | Accelerator pedal in rest position:<br>Fully depress accelerator pedal:  | infinity Ω<br>0...10 Ω             |
| 7         | <br>V       | 10 | 12 - 11        | Resistance of low-idle-<br>speed control test pin   | Apply test pin to ground   | 0...10 Ω                           |
| 8         | <br>V       | 11 | 10 - 11        | Resistance of idle<br>actuator, winding 1   | Sensor-heater plug<br>remains jumped.<br>+15...+30°C:<br>approx. +80°C:  | 20...32 Ω<br>24...37 Ω             |

# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: 1 684 463 141

| Test step | Switch | Terminals | Testing of component/function | Test instructions/<br>Test conditions                                 | Set values  |  |
|-----------|--------|-----------|-------------------------------|---|---|--|
|           | V    Ω |           |                               |   |   |  |
| 9         | <br>V  | 12        | 23 - 11                       | Resistance of idle actuator, winding 2                                | Adapter lead remains connected to periphery.<br>After test, remove jumper from sensor-heater plug and connect sensor. | +15...+30°C: 18...30 Ω<br>approx. +80°C: 22...34 Ω |
| 10        | <br>V  | 13        | 15 - 11                       | Overrun-cutoff suppression  | Not applicable  |  |
| 11        | <br>V  | 21        | 14 - 6                        | Resistance, idle-mixture potentiometer                                | Dependent upon the CO adjustment  | 150...600 Ω  |
| 12        | 5      | 21        | 1 - 11                        | TD signal from ignition trigger box term. 7 via TD amplifier          | Transmission in neutral, start engine   | Rectangular pulse on oscilloscope                  |
| 13        | 6      | 21        | 9 - 11<br>(+) (-)             | Voltage of main relay term. 87  | Press push-button 4   | 8...15 V   |
| 14        | 7      | 21        | 18 - 11<br>(+) (-)            | Voltage from ignition and starting switch                             | Ignition "ON"   | 8...15 V   |
| 15        | 8      | 21        | 21 - 11<br>(+) (-)            | Voltage at main relay term. 85  |   | 8...15 V   |
| 16        | 9      | 21        | 17 - 11<br>(+) (-)            | Voltage at pump relay term. 85 via charge-air-pressure sensing switch | Press push-button 4   | 8...15 V   |

# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

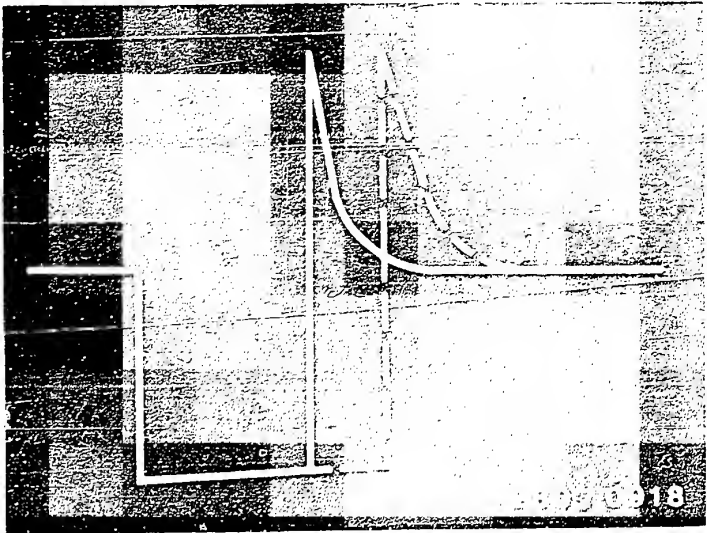
Adapter cable: 1 684 463 141

| Test step | Switch |          | Terms.  | Inspection of component/function   | Test instructions/<br>Test conditions   | Set values                  |
|-----------|--------|----------|---------|--|---|-----------------------------|
|           | V      | $\Omega$ |         |  |   |                             |
| 17        | 10     | 21       | 16 - 11 | Voltage at auxiliary-fan relay (only with air conditioner)                           | Connect adapter cable to peripherals and control unit.<br>Let engine run.<br>Switch on air conditioner. | 8...15 V                    |
| 18        | 3      | 21       | 7 - 6   | Output voltage, hot-wire air-mass sensor   | Let engine run. The output voltage must change as engine speed changes.                                 | 2...5 V                     |
| 19        | 11     | 21       | 22 - 11 | Voltage at integrator output, lambda closed-loop control (open-loop control value)   | Let engine run up to operating temperature.   | 10...13 V                   |
| 20        | 11     | 22       | 22 - 11 | Voltage at integrator output, lambda closed-loop control (rich value)                | Let engine run up to operating temperature.   | 10...13 V                   |
| 21        | 11     | 23       | 22 - 11 | Voltage at integrator output, lambda closed-loop control (lean value)                | Let engine run up to operating temperature.   | less than 0.5 V             |
| 22        | 11     | 24       | 22 - 11 | Voltage at integrator output, lambda closed-loop control (closed-loop control value) | Let engine run up to operating temperature.<br>Conduct measurement at approx. 2500 min <sup>-1</sup>    | 0...13 V<br>oscillating     |
| 23        | 11     | 24       |         | Basic idle speed   | Let engine run up to operating temperature.<br>Connect test pin (idle-speed control) to ground.         | 725...775 min <sup>-1</sup> |



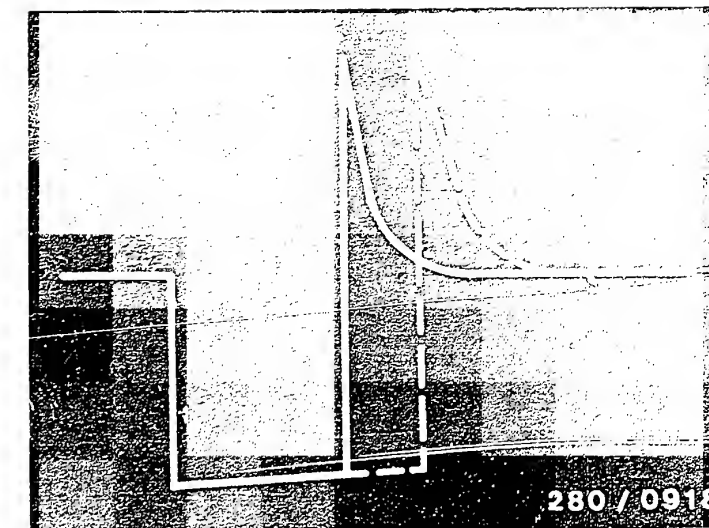
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01  
Adapter lead: 1 684 463 141

| Test | step | Switch | Termi-  | Testing of components/function   | Set values                                 |
|------|------|--------|---------|--|--|
|      |      | V      | nals    | Test instructions/conditions   |  |
| 24   | 11   | 24     |         | On/off ratio at idle actuator<br><br>Measurement with dwell-angle tester at sockets 1 and 2<br>Apply LFR* test pin to ground :<br>Loosen LFR test pin from ground:<br>In addition, switch on air conditioner (if fitted) :<br>Accelerate; above 3000 min <sup>-1</sup> ,<br>on/off ratio must increase :<br>(*LFR = Idle mixture control.) | 29,9 %<br>31...33 %<br>34...37 %<br>> 36 % |
| 25   | 12   | 24     | 13 - 11 | Injection signal t <sub>1</sub><br><br>Leave engine running (at normal operating temperature)..  | See upper illustration                     |
| 26   | 12   | 24     | 13 - 11 | Injection signal t <sub>1</sub><br>Temperature sensor cold<br><br>Leave engine running (at normal operating temperature). Press push-button 1. Duration of injection, engine speed and CO content become greater.  | See upper illustration                     |
| 27   | 12   | 24     | 13 - 11 | Injection signal t <sub>1</sub><br>Temperature sensor warm<br><br>Leave engine running (at normal operating temperature). Press push-button 2. Duration of injection must remain constant.   | See upper illustration                     |



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01  
 Adapter lead: 1 684 463 141

| Test step | Switch |    | Terminals | Testing of component/function<br>Test instructions/conditions   | Set values   |
|-----------|--------|----|-----------|---|--|
|           | V      | Ω  |           |   |  |
| 28        | 12     | 24 | 13 - 11   | <p>Injection signal t<sub>1</sub><br/>Full-load enrichment</p> <p>Leave engine running (at normal operating temperature). Press push-button 6. Duration of injection, engine speed and CO content become greater.</p>                     | See upper illustration                             |
| 29        | 13     | 24 | 8 - 11    | <p>Hot-wire air-mass flow sensor, self-cleaning operation</p> <p>Engine must run at speed exceeding 2000 min<sup>-1</sup> and the engine temperature be greater than +60° C. Then, ignition "OFF" - voltage reading after approx. 4s.</p> | <p>2...5 V</p> <p>Reading duration approx. 1s.</p> |



## TEST SPECIFICATIONS

| Component/function   | Set values                          |
|--|-------------------------------------|
| Electric fuel pump   |                                     |
| * Fuel delivery at return:   | at least 900 cm <sup>3</sup> /30 s  |
| * Supply voltage under load:   | at least 12 V                       |
| * Fuel delivery from pre-supply pump                                 | at least 1000 cm <sup>3</sup> /30 s |
| Pressure regulator   |                                     |
| * Fuel pressure with engine at standstill:                           | 2,3...2,7 bar                       |
| at idle:   | approx. 0.5 bar lower               |
| at 0.5 bar charge-air pressure:                                      | approx. 0.5 bar higher              |
| Fuel system, leakage   |                                     |
| * Fuel pressure after 20 mins. with engine at standstill             | at least 1.0 bar                    |
| Idle actuator  |                                     |
| * Resistance value at +15...+30°C between term. 2 and term. 3:       | 17...22,5 Ω                         |
| term. 2 and term. 1:   | 19...25,0 Ω                         |
| Hot-wire air-mass flow sensor  |                                     |
| * Resistance value between term. 6 and term. 3:                      | 0...1100 Ω                          |
| term. 5 and term. 3:   | 3.6...4.1 Ω                         |
| Temperature sensor (engine)  |                                     |
| * Internal electrical resistance at ambient temperature +15...+30°C: | 1.45...3.3 k Ω                      |
| with engine at norm. op.temp. approx. +80°C :                        | 280...360 Ω                         |

## TEST SPECIFICATIONS (Continued)

| Component/function  | Set values                                       |
|---|--|
| Solenoid-operated injection valve   |  |
| * Internal electrical resistance at ambient temperature +15...+30°C:                | 14.5...17.0 Ω                                    |
| * Leakage after 60 s:   | No drop must fall                                |
| Start control   |  |
| * Voltage at injection valve on start initiation:                                   | greater than 1.5 V                               |
| after approx. 15s:  | approx. 0.5 V                                    |
| Idle adjustment   |  |
| Eng. at norm. op. temp., approx. +80°C  |  |
| * Idle speed:   | 800...950 min <sup>-1</sup>                      |
| with on/off ratio:  | 31...33 %  |
| * Basic engine speed (test pin to ground):  | 725...775 min <sup>-1</sup>                      |
| CO adjustment   | Not applicable due to lambda closed-loop control |
| Integrator voltage  |  |
| * Closed-loop control (sensor connected must be hot)                                |  |
| Reading fluctuates between:   | 0...13 V   |
| * Open-loop control (disconnect sensor lead):                                       | 10...13 V  |
| * Rich value (sensor lead disconnected and applied to ground at control-unit side): | 10...13 V  |
| * Lean value (apply 2 V to the sensor lead on control-unit side):                   | less than approx. 0.5 V                          |

# TEST SPECIFICIATIONS (continued)

| Component/function | Set values |
|--------------------|------------|
|--------------------|------------|

|                            |  |
|----------------------------|--|
| Exhaust turbo-supercharger |  |
|----------------------------|--|

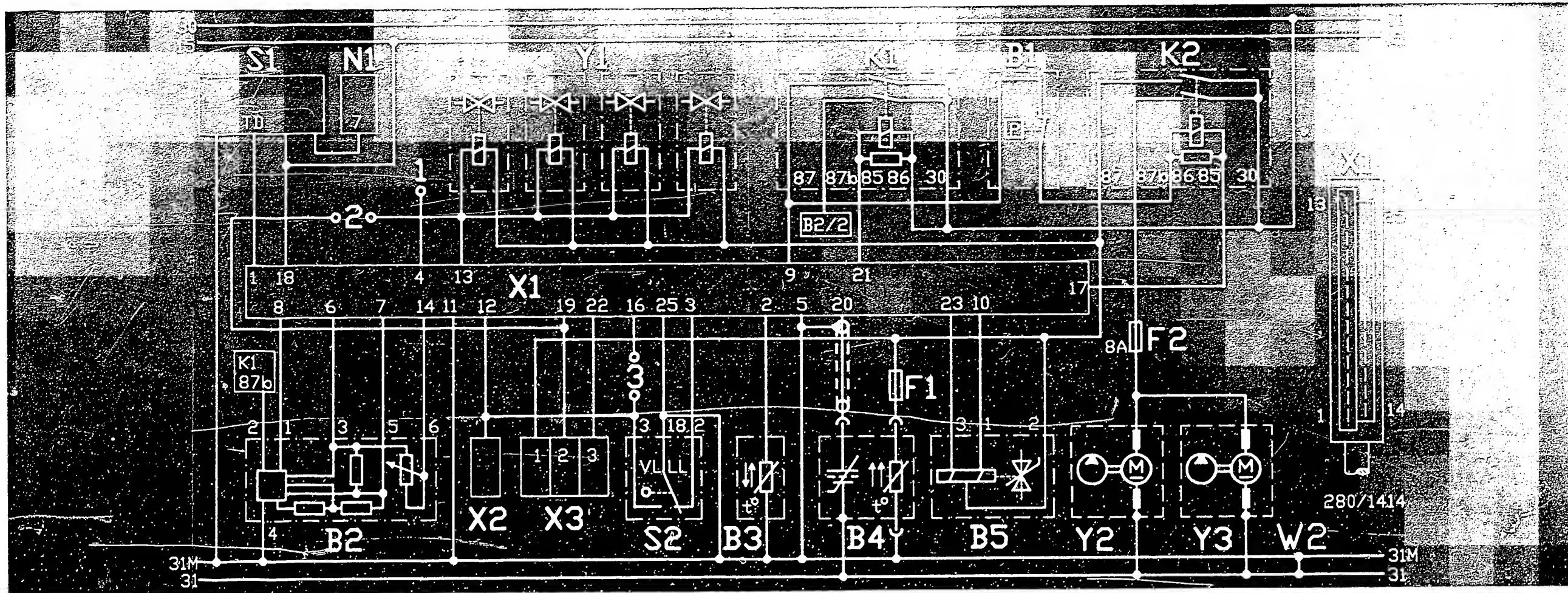
|   |                 |
|---|-----------------|
| * Max. charge-air pressure:             | 0,7...0,8 bar   |
| * Basic charge-air pressure:            | 0,32...0,38 bar |
| * Pressure monitor (switching pressure) | 0,9...1,0 bar   |

|                      |  |
|----------------------|--|
| Lambda sensor heater |  |
|----------------------|--|

|   |                 |
|---|-----------------|
| * electrical internal resistance (PTC) with engine stopped: | 1...15 $\Omega$ |
|---|-----------------|

For setting values for ignition, valve clearance and other technical engine data, see equipment and autodata microcard.

For production reasons:  
continued on the following  
coordinate.



# ELECTRICAL TERMINAL DIAGRAM

B1 = Charge-air-pressure monitor  
 B2 = Hot-wire air-mass sensor  
 B3 = Temperature sensor (engine)  
 B4 = Heated lambda sensor  
 B5 = Idle actuator  
 F1 = Fuse, sensor heater  
 F2 = Fuse, fuel pumps  
 K1 = Main relay  
 K2 = Pump relay

N1 = Ignition trigger box  
 S1 = TD amplifier  
 S2 = Throttle-valve switch  
 W2 = Ground-strap, engine  
 X1 = Control-unit plug  
 X2 = Test pin (idle-speed control)  
 X3 = Test connection  
 1 Positive voltage from pump relay  
 2 Limp-home indication

3 Integrator voltage (■)  
 Y1 = Solenoid-operated injection valves  
 Y2 = In-tank fuel pump  
 Y3 = In-tank pre-supply pump  
 1 = Drive switch (automatic)  
 2 = to on-board computer  
 3 = Auxiliary-fan relay  
 (with air conditioner)

## INSTALLATION POSITION OF COMPONENTS

The indications "right" and "left" always refer to the forward direction of travel.

### \* LH-Jetronic control unit (upper illustration, Item 1)

The control unit is located on the left behind the engine firewall beneath a cover.

For connecting the universal test adapter, remove control unit and disconnect control-unit plug. To do this, press open latch (locking tongue).

### \* Fuel-pump fuse (center illustration, No. 14).

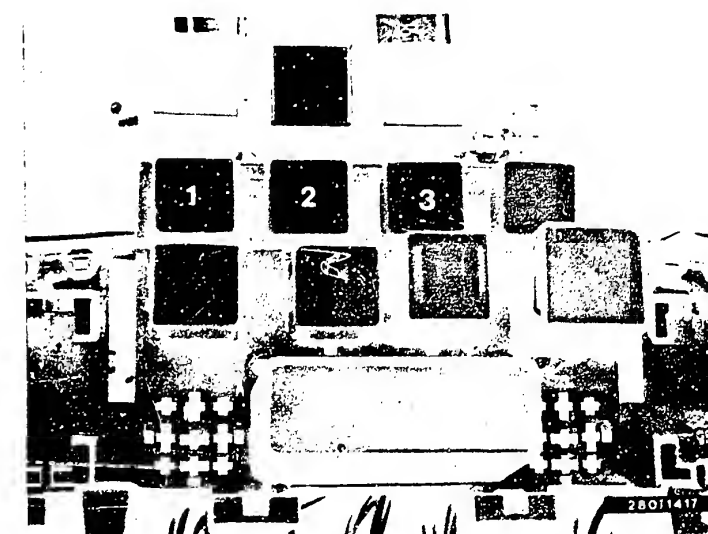
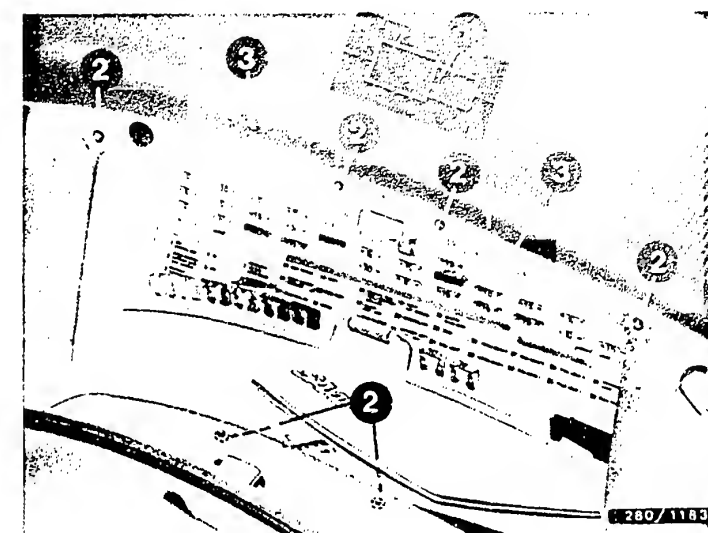
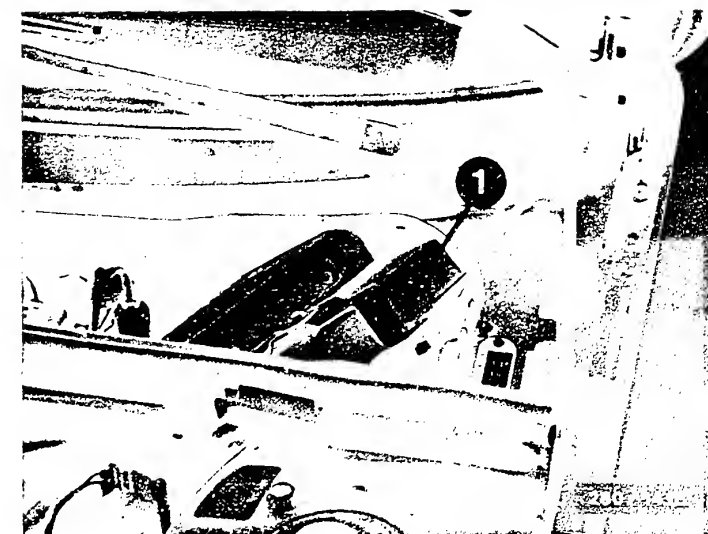
### \* Safety circuit (switch on electric fuel pump for measurement), center illustration.

Open glove compartment and remove cover above fuse box. Pull out fuses Nos. 14 and 22 and insert auxiliary lead (Item 1) with 8 A fuse element.

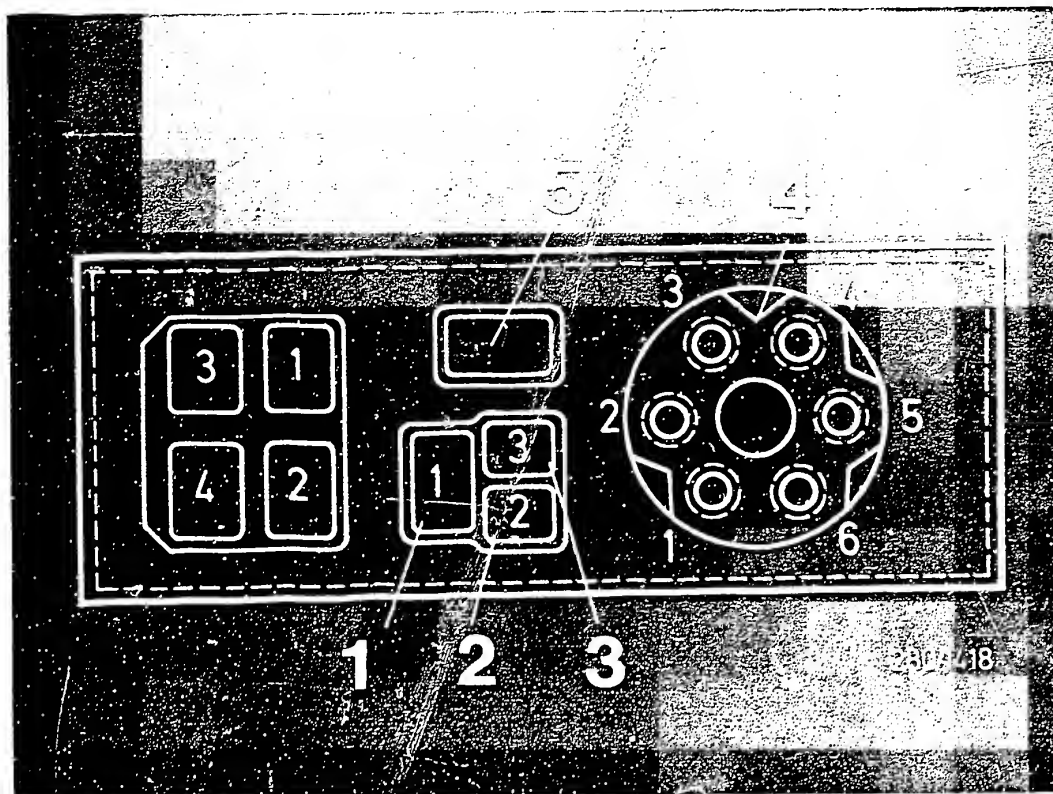
### \* Main and pump relays and TD amplifier (lower illustration).

Remove glove compartment. To do this, loosen 4 screws at top and 2 screws at bottom (center illustration, Item 2). Unlatch right-hand vent grille. Remove fuse box. Loosen screws (center illustration, Item 3). Pivot relay plate downwards.

Lower illustration:: 1 = Main relay  
2 = Pump relay  
3 = TD amplifier







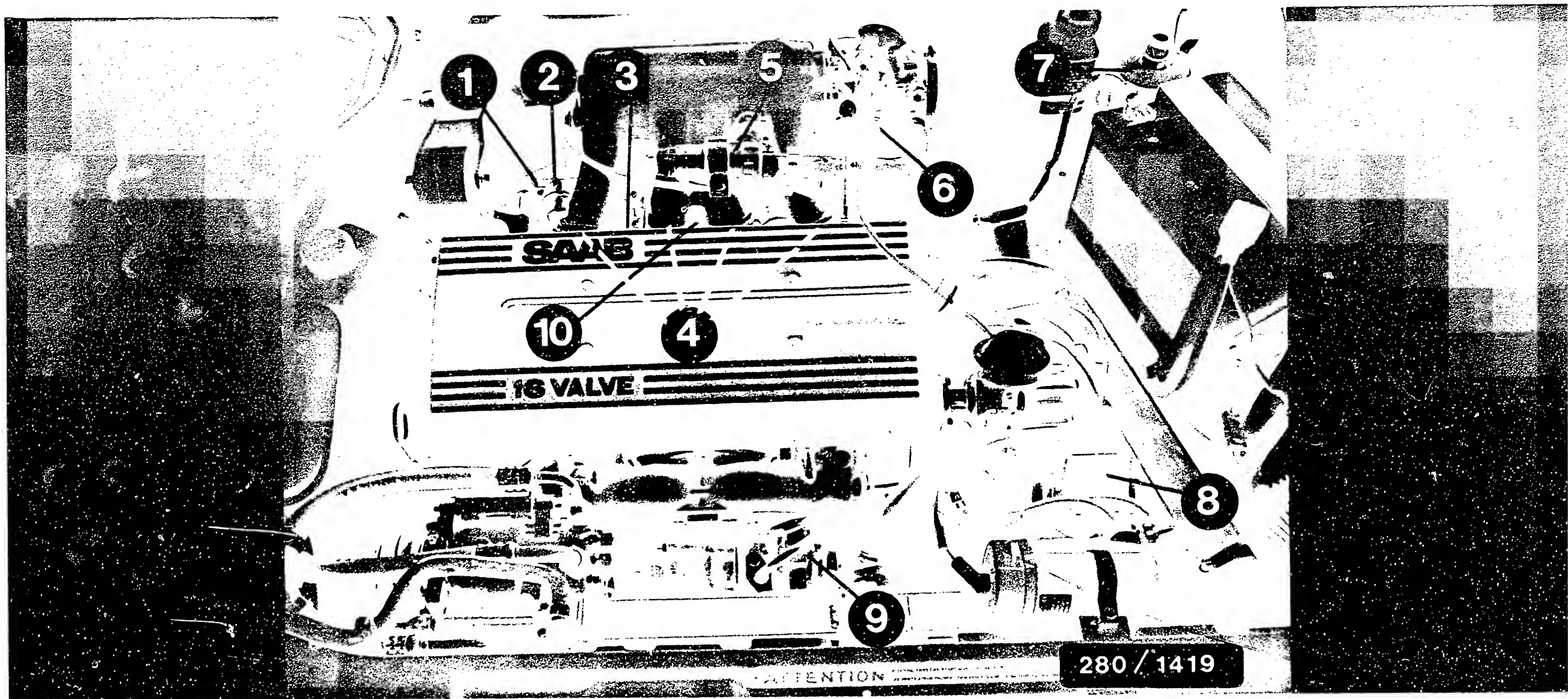
- 1 = Positive voltage from pump relay
- 2 = Limp-home indicator
- 3 = Integrator voltage ( ■ )
- 4 = TSI socket
- 5 = Test pin (low-idle-speed control)

#### TEST CONNECTION

The connection point for the ignition-point check (TSI socket), as well as for the LH system are located together in one common test connection which is positioned in the engine compartment on the left-hand side behind the engine firewall.

#### Further installation positions

- \* Ground points for injection system  
On engine block at rear on right, beneath the pressure regulator.
- \* Ground point for in-tank electric fuel pump and fuel-supply pump beneath left-hand section of rear seat.
- \* Lambda sensor in exhaust pipe ahead of catalytic converter.  
Plug-in connection for sensor signal and heater beneath the intake manifold.  
Fuse for sensor heater in form of cable fuse close to windscreen wiper motor.
- \* Charge-air-pressure monitor beneath the instrument panel, on left next to steering column (beneath the knee protector). Over 1.05 bar charge-air pressure, switches the electric fuel pump off.
- \* Knock control (APC system)  
Trigger box beneath instrument panel, close to charge-air-pressure monitor.  
Knock sensor on engine, beneath intake manifold.  
Solenoid-operated valve on fan housing.  
Pressure sensor next to trigger box.  
Vacuum-operated switch next to trigger box.



# Components on the engine

- |  |                              |                                |
|--|------------------------------|--------------------------------|
| 1 = Ground terminals                   | 5 = Idle adjuster            | 9 = Exhaust turbo-supercharger |
| 2 = Pressure regulator                 | 6 = Throttle-valve switch    | 10 = Knock sensor              |
| 3 = Temperature sensor (engine)        | 7 = Fuel filter              |                                |
| 4 = Solenoid-operated injection valves | 8 = Hot-wire air-mass sensor |                                |

## Upper illustration

- 1 = In-tank electric fuel pump
- 2 = Electrical connection, in-tank pre-supply pump
- 3 = Electrical connection, fuel-level sensor

## Removing the in-tank electric fuel pump

- Disconnect battery.
- Fold up rear part of the luggage-compartment floor, unscrew both fastening screws and remove the floor.
- Turn both bayonet sockets, lift up the flap and push back slightly.
- Loosen electrical connections from electric fuel pump, pre-supply pump and fuel-level sensor.
- Pinch off fuel-injection line with hose clammer.
- Unscrew inlet-union screw from the pressure connection of the electric fuel pump and pull off ring connection with fuel-injection line. Attention! Fuel may escape. Take necessary safety measures.
- Remove clamp (8) from sealing collar (9) of the electric fuel pump.
- Pull up electric fuel pump together with tank, disconnect fuel return hose from tank (5), loosen line of pre-supply pump from tank lead-through.
- Pull electric fuel pump out of tank (6) and remove strainer (7).
- Unscrew clamp (8) from sealing column (9) and pull electric fuel pump out of the collar.

## Installing

- Mount sealing collar in such a way that its edge lies 50 mm above the upper edge of the fuel pump.
- Secure suction strainer (7), insert fuel pump into tank (6), position new O-ring.
- Install fuel pump in such a way that the overpressure valve of the fuel pump is offset by 45° in relation to the sealing-collar mark (10).
- Adjust overall height of the fuel pump to 250 mm.
- Proceed further in reverse sequence of steps as described under "Removing the in-tank electric fuel pump".

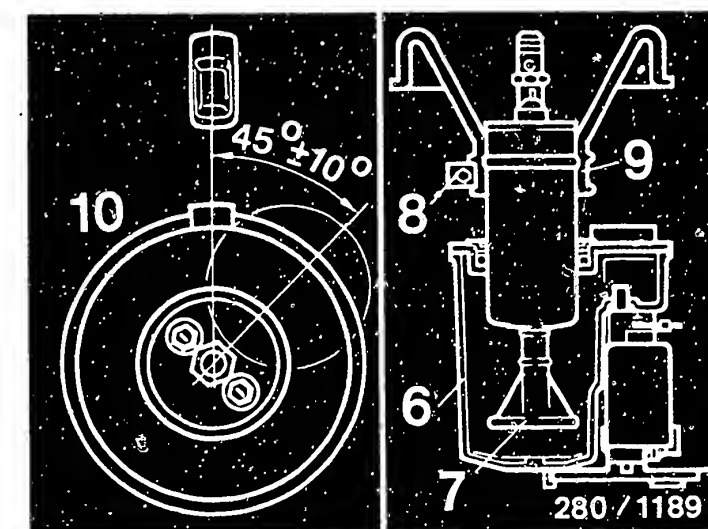
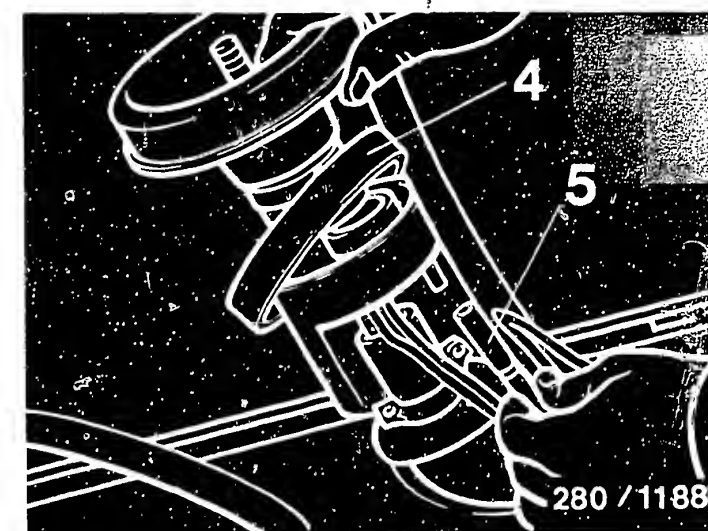
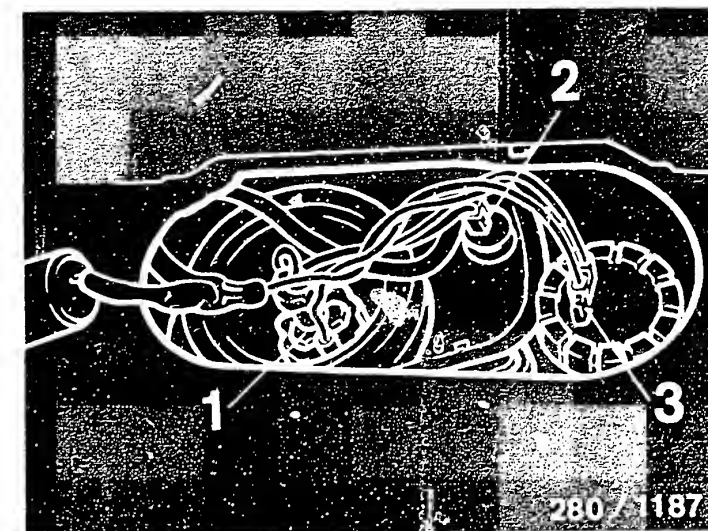


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Trouble-shooting instructions: VWV-5003

BOSCH system : Ecotronic (4.0)

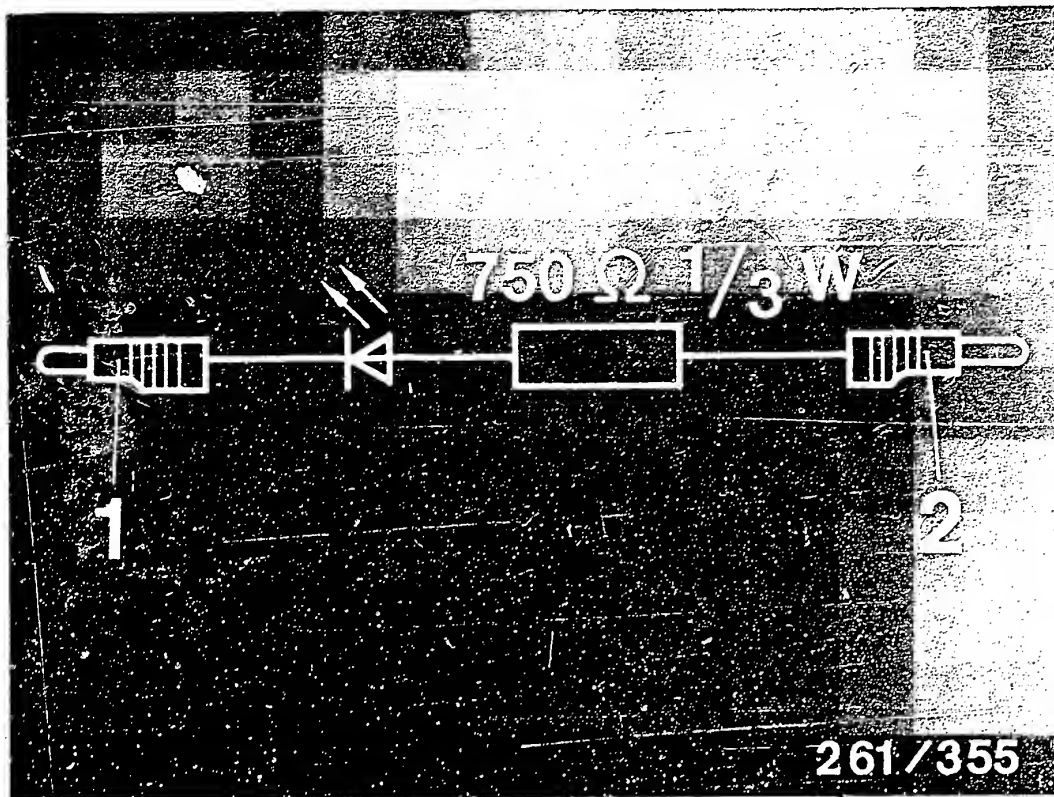
Make of vehicle : VWV

Basic microcard : MB-530

| Section  | Coordinate |
|--|------------|
| Special features, safety, usage.....                     | 02         |
| Trouble-shooting chart.....                              | 05         |
| Rapid diagnosis chart for universal<br>test adapter..... | 07         |
| Test specifications.....                                 | 15         |
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SPECIAL FEATURES

- \* This microcard contains the ECO 4.0 trouble-shooting instructions, valid at the time of publication, for the following VWmodels:  
  
Golf 1,6 l and Passat 1,6 l  
with manually shifted transmission  
(03.87 ->)
- \* Ecotronic with lambda closed-loop control (ECO 4.0) with 25-pin control unit.
- \* If a sensor fails, the control unit operates with specified substitute values.
- \* The system is similar to the Ecotronic (ECO 3), MB 190, 200  
see SIS MB-530.



### SPECIAL FEATURES (Continued)

In addition to the testers described in the basic instructions, another test lead (self-fabricated) is required for adjusting the lambda closed-loop control range (see illustration).

1 = Connection for LED at unassigned lead in engine compartment      2 = Connection for U<sub>B</sub>

### STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Finding individual test steps in the brief and basic instructions is made easier through the use of identical test-step numbers.

### SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

#### \* C A U T I O N !

High-performance ignition system.  
Dangerous primary and secondary voltages.

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For further precautionary measures, see basic instructions.



## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty
2. Engine starts but then dies.
3. Rough idling  
(engine speed, exhaust gas)
4. Poor throttle response,  
flat spot during acceleration
5. Engine misfiring  
(ignition, fuel induction)
6. Maximum engine power/  
top speed not reached
7. Fuel consumption too high
8. Engine running on (dieseling)
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp

Cause (component fault)

|   |   |   |   |   |   |   |   |   |   |   |  |                                    |
|---|---|---|---|---|---|---|---|---|---|---|--|------------------------------------|
| * | * | * | * | * | * | * | * | * | * | * |  | Test with universal adapter        |
|   |   |   |   |   |   |   |   | * | * |   |  | Fuel not to DIN                    |
| * |   |   | * | * | * |   |   |   |   |   |  | Fuel pressure outside tolerance    |
|   | * |   | * | * |   |   |   |   |   |   |  | Fuel delivery outside tolerance    |
| * | * | * | * | * | * | * |   |   |   |   |  | Choke-valve flap stiff             |
| * | * |   | * | * |   |   |   |   |   |   |  | Float/float-needle valve           |
| * | * | * | * | * | * |   |   |   |   |   |  | Dirt in carburetor                 |
|   | * | * | * | * | * |   |   |   |   |   |  | Induction system leaking           |
|   | * | * |   |   |   |   |   |   |   |   |  | Intake-manifold heating            |
|   | * | * |   |   |   |   |   |   |   |   |  | Intake-air preheating              |
|   | * |   |   |   |   | * |   |   |   |   |  | Adjustment, throttle valve stage I |
|   | * | * | * | * | * | * |   |   |   |   |  | Incorrect nozzle type              |
|   |   | * | * | * |   |   |   |   |   |   |  | Vacuum unit stage II               |
|   | * | * | * | * |   |   |   |   |   |   |  | Adjustment, throttle vlv. stage II |
|   | * | * | * | * | * |   |   |   |   |   |  | Adjustment, accelerator actuation  |
|   | * | * |   |   |   |   |   |   |   |   |  | Throttle valve worn                |

M05

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling  
(engine speed, exhaust gas)
4. Poor throttle response,  
flat spot during acceleration.
5. Engine misfiring  
(ignition, fuel induction)
6. Maximum engine power/  
top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)

|  |   |   |   |   |   |   |   |   |   |  |  |                                  |
|--|---|---|---|---|---|---|---|---|---|--|--|----------------------------------|
|  | * |   |   |   |   |   |   |   |   |  |  | Idle adjustment                  |
|  | * | * | * |   |   |   |   |   |   |  |  | Bypass heating defective         |
|  | * | * | * | * | * |   |   |   |   |  |  | Exhaust-gas system defective     |
|  | * | * | * | * | * |   |   |   |   |  |  | Lambda sensor defective          |
|  | * | * | * | * | * | * | * | * | * |  |  | Test ignition system             |
|  |   | * | * |   |   |   |   |   |   |  |  | Release/forced return, stage II. |

M06



# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: 1 684 146 182

| Test step | Switch<br>V | $\Omega$ | Testing of<br>component/function  | Test instructions/<br>Test conditions  | Termi-<br>nals | Set values                             |
|-----------|-------------|----------|---|--|----------------|--|
| 1         | <br>V       | 1        | Choke-valve actuator,<br>insulation resistance  | Make bridge, socket 1/socket 2 to universal<br>test adapter. Ignition switched off, control<br>unit not connected. | 12 2           | Greater than 1M $\Omega$               |
| 1.1       | <br>V       | 2        | Intake-manifold heating relay,<br>winding resistance  |  | 14 2           | Less than 100 $\Omega$                 |
| 2         | <br>V       | 3        | Choke-valve actuator<br>winding resistance  |  | 12 10          | Less than 10 $\Omega$                  |
| 3         | <br>V       | 9        | Coolant-temperature sensor  | Set value is temperature-dependent: at + 20°C:<br>at + 80°C:   | 21 7<br>21 7   | 2...3 k $\Omega$<br>280...360 $\Omega$ |
| 3.1       | <br>V       | 10       | Intake-manifold temperature sensor  | Set value is temperature-dependent: at + 20°C:<br>at + 80°C:   | 5 7<br>5 7     | 2...3 k $\Omega$<br>280...360 $\Omega$ |
| 4         | <br>V       | 7        | Ground cables,<br>resistance  |  | 20 2           | Less than 10 $\Omega$                  |
| 4.1       | <br>V       | 12       | Solenoid-operated valve, evacuating,<br>in throttle-valve actuator,<br>insulation resistance      |  | 9 2            | Greater than 1 M $\Omega$              |
| 4.2       | <br>V       | 13       | Solenoid-operating valve,<br>ventilating,<br>in throttle-valve actuator,<br>insulation resistance |  | 3 2            | Greater than 1M $\Omega$               |
| 5         | <br>V       | 17       | Solenoid-operated valve, evacuating,<br>in throttle-valve actuator,<br>winding resistance         |  | 9 23           | 20...80 $\Omega$                       |
| 6         | <br>V       | 18       | Solenoid-operated valve,<br>ventilating,<br>in throttle-valve actuator,<br>winding resistance     |  | 3 23           | 20...80 $\Omega$                       |
| 8         | <br>V       | 20       | Resistance, potentiometers,<br>throttle-valve actuator and<br>throttle valve                      | Potentiometers are connected in parallel   | 18 7           | 0,7...1,3 k $\Omega$                   |

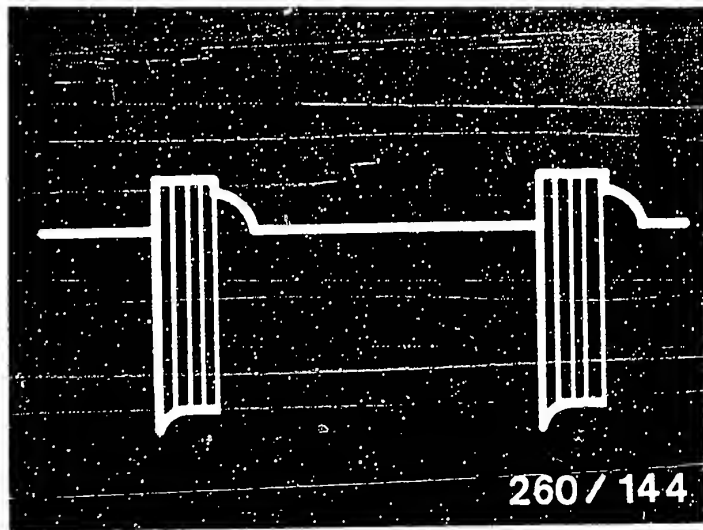
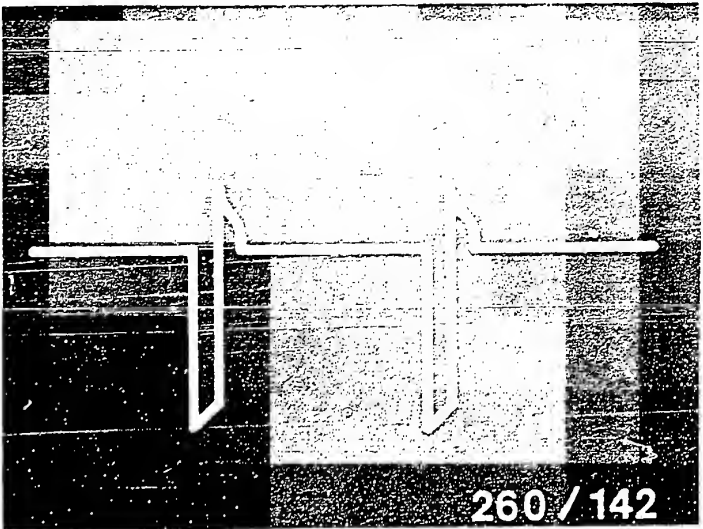
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 Continued  
 Adapter lead: 1 684 146 182

| Test step | Switch<br>V | $\Omega$ | Testing of component/function<br>Test instructions/conditions   | Termi-<br>nals | Set values   |
|-----------|-------------|----------|---|----------------|--|
| 10        | 3           | 20       | Supply voltage, control unit<br>(Control unit connected)  | 1 2            | Greater than 10 V  |
| 10.1      | 4           | 20       | Switch on ignition.<br>Voltage supply of solenoid-operated<br>valves in throttle-valve actuator.  | 23 2           | Greater than 10 V  |
| 11        | 5           | 20       | Connect ignition oscilloscope with black<br>clip to black measuring recess and with<br>red clip to red measuring recess of<br>universal test adapter.<br><br>Engine is running and at normal<br>operating temperature. Measurement of<br>engine-speed signal and pulses during<br>starting procedure. | 25 2           | See upper<br>illustration                                    |
| 12        | 6           | 20       | Voltage supply term.15  | 13 2           | Greater than 10 V  |
| 13        | 7           | 20       | Supply voltage for potentiometers<br>(throttle valve and throttle-valve<br>actuator)  | 18 2           | 4,5...5,5 V  |
| 14        | 8           | 20       | Voltage supply, hedgehog-heating<br>relay in intake manifold  | 14 2           | Greater than 10 V  |
| 16        | 10          | 20       | Test throttle-valve actuator:<br>remove bridge socket 1/socket 2 at<br>universal test adapter.<br><br>Press push-button T3 at universal test<br>adapter.<br>Rod of throttle-valve actuator moves<br>into overrun position.<br>Engine dies.<br>Value may change a max. of<br>0,2 V within 30 seconds.  | 17 2           | 0,1...0,8 V<br>↓<br>V<br>After approx. 30 s.<br>+ max. 0,2 V |



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 Continued  
Adapter lead: 1 684 146 182

| Test step | Switch<br>V | $\Omega$ | Testing of component/function<br>Test instructions/conditions   | Termi-<br>nals | Set values  |
|-----------|-------------|----------|---|----------------|---|
| 17        | 11          | 20       | Test throttle-valve potentiometer:<br>slowly push accelerator pedal to floor.<br><br>Voltage value increases continuously<br>between min. and max. .  | 11 2<br>11 2   | Min: 0,05...0,6 V<br>Max: 4,2...5,5 V                           |
| 18        | 10          | 20       | Test throttle-valve actuator<br>(ventilating side):<br>Apply lead from socket 2 at universal<br>test adapter 1 s. to ground (e.g. black<br>measuring recess).<br><br><u>Attention:</u> under no circumstances allow<br>socket 1 at universal test adapter to<br>make contact with positive (e.g. red<br>measuring recess) | 17 2           | 0,3...1,0 V<br>After 1 s.<br>↓<br>V<br>2,8...4,2 V              |
| 19        | 12          | 20       | Measurement of signal for choke-valve<br>actuator:<br><br>Make bridge socket 1/socket 2 at<br>universal test adapter.<br><br>Start engine.  | 12 2           | See upper<br>illustration                                       |
| 20        | 12          | 20       | As 19, however, signal becomes wider<br>when push-button T5 at universal test<br>adapter is pressed (simulation, cold<br>engine)  | 12 2           | See lower<br>illustration                                       |
| 21        | 12          | 20       | Acceleration enrichment:<br>Briefly actuate accelerator pedal.<br>Signal becomes wider.   | 12 2           | See lower<br>illustration                                       |
| 23        | 13          | 20       | Actuation of ventilating valve in<br>throttle-valve actuator:<br><br>Switch off ignition.<br><br>Then pay attention to time and voltage<br>value!   | 3 2<br>3 2     | Greater than 10 V<br>after approx.<br>5...20 s<br>Less than 1 V |



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 Continued  
 Adapter lead: 1 684 146 182

| Test step | Switch<br>V | $\Omega$ | Testing of component/function<br>Test instructions/conditions  | Termi-<br>nals    | Set values  |
|-----------|-------------|----------|--|-------------------|---|
| 24        | 14          | 20       | Start engine.<br>Actuation of evacuating valve in<br>throttle-valve actuator:<br>Switch on ignition.<br>Then pay attention to time and voltage<br>value!   | 9 2<br>9 2<br>9 2 | Less than 1 V<br>after approx. 12 s<br>Greater than 10 V<br>after further<br>approx. 3 s<br>Less than 1 V |
| 26        | 23          | 20       | Lambda closed-loop control, open-loop<br>control value at test output. Connect<br>test lead with LED to unassigned lead<br>in engine compartment.<br>Engine runs and has normal operating<br>temperature | 6 2               | LED<br>flashes at<br><br>high<br>frequency  |
| 27        | 23          | 22       | Lambda closed-loop control, rich value<br>at test output   | 6 2               | LED<br>goes out   |
| 28        | 23          | 23       | Lambda closed-loop control, lean value<br>at test output   | 6 2               | LED lights up   |
| 29        | 23          | 24       | Lambda closed-loop control, closed-loop<br>control value at test output  | 6 2               | LED flashes<br>at approx. 2 Hz  |
| 29.1      | 18          | 20       | Transmission identification<br>Vehicles with manually shifted<br>transmission:<br>Vehicles with automatic transmission:  | 16 2<br>16 2      | Approx. 0...5 V<br>Greater than 6 V   |
| 31        | —           | —        | Test CO value.<br>Connect CO analyzer to exhaust-sample<br>pipe in front of the catalytic<br>converter.<br>(Hose for crankshaft ventilation<br>disconnected; lead to lambda sensor<br>disconnected).     | —                 | % CO by vol.  |

## TEST SPECIFICATIONS:

Idle speed: 900  $\pm$  75 min<sup>-1</sup>

Adjust lambda closed-loop-control range:

Run engine to warm up until at normal operating temperature (approx. 80°C). Increase engine speed for 30 s. to greater than 2000 min<sup>-1</sup>, so that the lambda sensor is sure to be at normal operating temperature. Afterwards, immediately connect test lead to unassigned lead in engine compartment and to battery term.30. Run engine at idle. LED of test lead must flash at approx. 1,5 Hz. If necessary, adjust at idle-mixture-adjusting screw.

Exhaust-gas adjustment:

Test CO value with engine at normal operating temperature (in vehicles with lambda closed-loop control, test at sampling pipe before catalytic converter): 0,2...1,0 %CO by vol.

Fuel pressure: 0,1...0,3 bar

Minimum fuel delivery  
(at 2000 min<sup>-1</sup>) 1 l/min

Float weight: 7,9  $\pm$  0,5 g  
Float height: 27,5  $\pm$  1,0 mm  
(Float cannot be adjusted)

Throttle-valve potentiometer

Total resistance: 1,4...2,6 k  $\Omega$   
Wiper resistance in  
correcting range: min. less than 270  $\Omega$   
max. 1,4...2,4 k  $\Omega$

Choke-valve actuator:

Winding resistance: 0,9...1,7  $\Omega$

Basic setting, throttle  
valve

Stage I (with feeler gauge) 3,15  $\pm$  0,1 mm  
Stage II a = 0,03  $\pm$  0,02 mm

## TEST SPECIFICATIONS (continued):

Release and forced return

Stage II:

Y = 1,0  $\pm$  0,2 mm

Z = 0,4  $\pm$  0,2 mm

Winding resistance, intake-  
manifold heating relay:

20...50  $\Omega$

Throttle-valve actuator

Evacuating valve (term.1/term.2): 20...70  $\Omega$

Ventilating valve (term.6/term.7): 20...70  $\Omega$

Total resistance, potentiometer  
(term.3/term.4): 1,4...2,6 k  $\Omega$

Wiper resistance in correcting  
range (term.5/term.3): min. less than 400  $\Omega$   
max. 1,4...2,4 k  $\Omega$

Temperature sensor (NTC:

Internal resistance at 20°C: 2,0...3,0 k  $\Omega$

at 80°C: 280...360  $\Omega$

Heating element, intake-manifold heating:

Internal resistance at 20°C: approx. 1,5  $\Omega$

Type of nozzle:

|   | Stage 1 | Stage 2      |
|---|---------|--------------|
| Main nozzle                                 | x 105   | x 110        |
| Idle fuel nozzle                            | x 45    |              |
| Acceleration fuel nozzle                    |         | 90           |
| Air correction nozzle<br>(with mixing tube) | x 110   | x 105        |
| Acceleration air nozzle                     |         | x 130        |
| Full-load enrichment                        |         | 100 $\pm$ 10 |

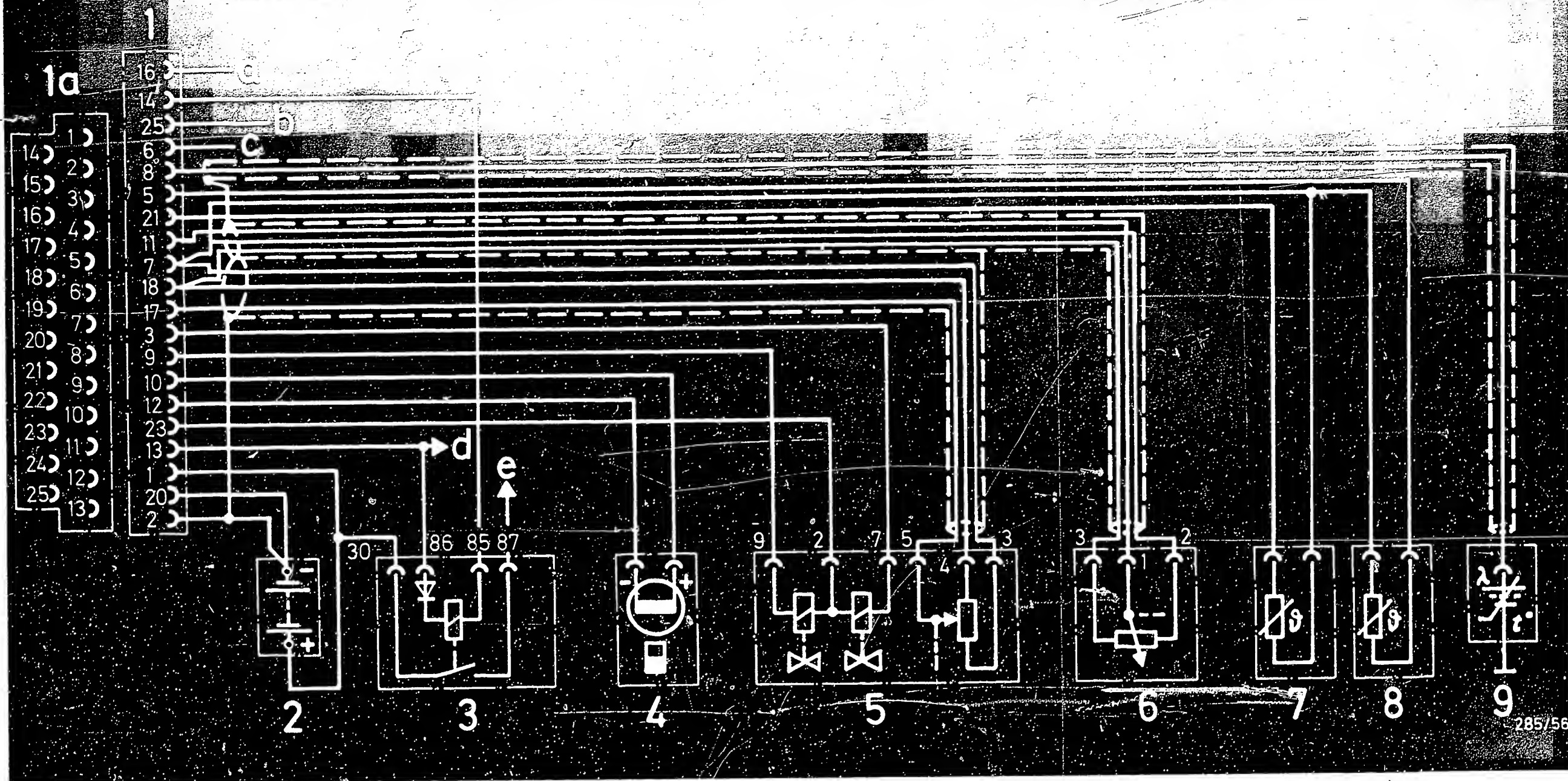
Tightening torques

Carburetor mounting 7 Nm

Flange mounting 13 Nm

See equipment and Autodata microcards for  
setting values for valve clearance and  
other engine-related data.





Electrical terminal diagram of the Ecotronic

1 = Control unit, Ecotronic

1a = Plug assignment

2 = Battery

3 = Relay, intake-manifold heating

4 = Choke-valve actuator

5 = Throttle-valve actuator (DKA)

6 = Potentiometer, main throttle valve

7 = Coolant-temperature sensor

8 = Intake-manifold temp. sensor

9 = Lambda sensor

a = Transmission identification

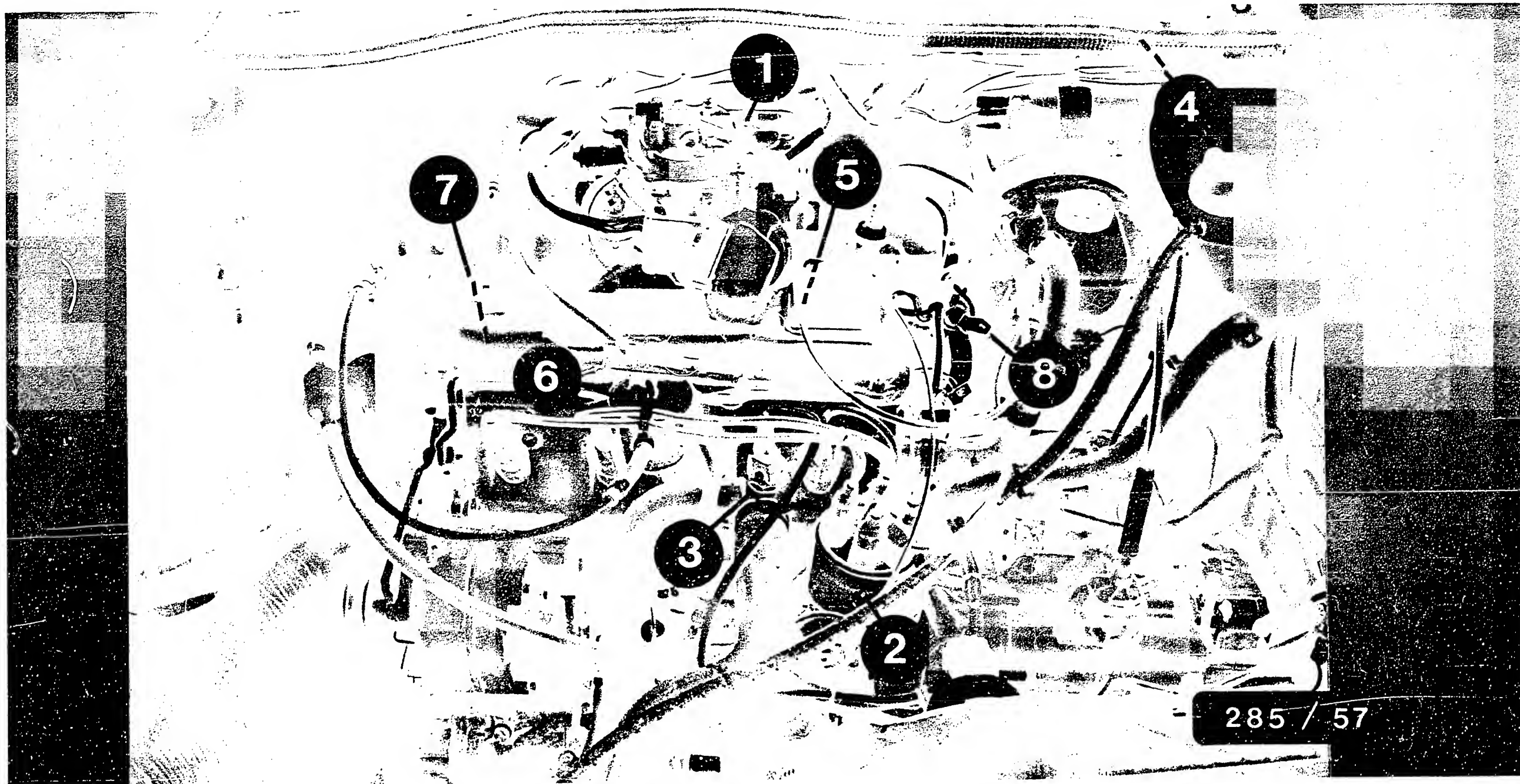
b = Td Signal

c = Unassigned lead for setting the control range of the lambda sensor

d = Term. 15

e = To heating element, intake-manifold heating





# Installation position of components

- |                                   |  |   |
|-----------------------------------|--|---|
| 1 = Carburetor                    | 4 = Control unit, Ecotronic<br>(beneath cover) | 7 = Sampling pipe for CO measurement                                    |
| 2 = Ignition distributor          | 5 = Intake-manifold temp. sensor               | 8 = Unassigned lead for adjustment of<br>control range of lambda sensor |
| 3 = Coolant-temperature<br>sensor | 6 = Vapor-bubble separator                     | Lambda sensor is installed in exhaust manifold                          |

Note: Installation position in Passat identical; engine is installed longitudinally.